This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

Mus
352
2.2

LOEB MUSIC LIBRARY
ML 12KB Y

Mus 352.2.2

VE RI TAS

HARVARD
COLLEGE
LIBRARY

MUSIC LIBRARY

THE ORGAN

AND ITS

CONSTRUCTION.

THE ORGAN

AND ITS

CONSTRUCTION;

A SYSTEMATIC

HAND-BOOK FOR ORGANISTS, ORGAN-BUILDERS, &c.

TRANSLATED FROM THE GERMAN

OF

[illegible]

J. J. SEIDEL,

ORGANIST AT BRESLAU.

REDUCED RATE

LONDON:
PUBLISHED BY EWER & CO., OXFORD STREET.

PRICE EIGHT SHILLINGS.

MDCCCLII.

Mus. 352.2.2
Dez - Jan 1994

1862, Sept. 8.
75 cts.
Gray Fund.

LONDON:
PRINTED BY J. BONSOR, 134, FENCHURCH STREET.

PREFACE.

It is a known fact, that he who wishes to attain proficiency on his instrument, must be intimately acquainted with its qualities. The more ingenious the mechanism of an instrument, the more requisite is the acquaintance with it on the part of those who have to handle it. The Organ is, undoubtedly, one of the most ingenious musical instruments, and being moreover designed for man's most blissful vocation, viz., the worship of God, it surely deserves our greatest attention. Convinced of this truth, the Ministry of Prussia have been induced to issue a decree, wherein the care of the Organ is made an imperative duty of the organist, and the study of its mechanism recommended to him. More especially does this decree extend to those who are to be engaged as teachers and (as is often the case in Germany) at the same time as organists. Now, as there has hitherto existed no compressed and popular work on the mechanism of the Organ, the Author (having been organist himself for several years, and having for the last fourteen years studied the nature of organ-building, both theoretically and practically, in the workshops of the famous organ-builders, Müller, junr. and senr.; having also had good opportunities for observation and experience during the intervals that the Messrs. Müller were from home, when he had to superintend the tuning and repairing of the organs intrusted to their charge) has resolved upon laying down his experience in the present book, thereby answering the many calls he has received for supplying this very perceptible want in musical literature.

The design of the book is two-fold:—1. To acquaint organists, etc., with the mechanism of the Organ, and to enable them thereby to discover and remedy any little faults that may arise; to prevent greater ones; to give due information to the respective authorities in case of a repair being necessary, and to keep the instrument in good condition.—2. To warn those who undertake the erection of an Organ against errors, and to furnish those who superintend such an undertaking with the requisite knowledge. How far the Author has succeeded in this, he leaves to competent judges to decide.

CONTENTS.

INTRODUCTION.

Page.
A Short History of the Organ 9

PART I.—EXTERIOR OF THE ORGAN.

Chapter I.—The Organ Case and the Position of the Front Pipes.... 32
Chapter II.—On Key-boards in general 33
Chapter III.—On Stops in general 35
Chapter IV.—On the Entrance to the Organ 35

PART II.

Chapter I.—The Bellows and Wind-conductors 36
Chapter II.—The Wind-conductors and Stopping-valves 44
Chapter III.—The Great Sound-board 47
Chapter IV.—The principal Valves or Palates 48
Chapter V.—The Wind-chest 52
Chapter VI.—The Upper-board 54

PART III.—THE ACTION.

Chapter I.—The Slides 57
Chapter II.—The connection between the Slides and Stops.......... 58
Chapter III.—The Action of the Manual and Pedal-Organ 62
Chapter IV.—The Copulas 67

PART IV.—THE PIPES.

Chapter I.—On Pipes in general 75
Chapter II.—Scale and Size of the Pipes 76
Chapter III.—The various kinds of Pipes, and their Structure 78
Chapter IV.—The Registers (or Stops) 84

PART V.

Page.
Alphabetical List of Registers, with their Size, Structure and other qualities 89

PART VI.—THE TREATMENT, PRESERVATION AND SUPERINTENDENCE OF THE ORGAN.

Chapter I.—General and Special Observations on the Art of Registering 111
Chapter II.—What is injurious to an Organ 116
Chapter III.—The Faults arising in an Organ, together with their Remedies 126
Chapter IV.—The Intonation, Tempering, and Tuning of an Organ .. 145

PART VII.—THE BUILDING, REPAIR, AND EXAMINATION OF AN ORGAN.

Chapter I.—What is to be principally regarded in the Building and Erection of an Organ 157
Chapter II.—The Arrangement of Registers in general, and the Temperament and Pitch of the Organ 169
Chapter III.—On the Arrangement or Composition of Registers in particular 171
Chapter IV.—Examination of a New or Repaired Organ 179

PART VIII.

Arrangements or Descriptions of various celebrated Organs 185

Appendix 206

INTRODUCTION.

A SHORT HISTORY OF THE ORGAN.

Among the many inventions of the human mind, the organ undoubtedly occupies a high rank. It is the most perfect of all musical instruments, and so completely attains the end for which it was invented, that its position may very properly be deemed permanent. Hence, organ building is one of the most difficult arts; for, if the skilful hand of the master is to produce a work perfectly answering its lofty purpose, he requires, not only extensive knowledge, but also the greatest accuracy and inexhaustible patience. In this, however, the organ builder will not, even then, succeed, unless he understands the mechanical part of his art well, and is likewise conversant with mathematics, natural philosophy, and acoustics,—as well as with the theory of the balance and force of bodies in general, and of the air in particular, as also with the theory of the diffusion and power of sound. Devoid of this higher knowledge, he will never attain great proficiency, nor ever deserve the name of a true artist. The art of organ building may rightly be called a sublime art; for no other instrument is so ingenious in its construction, and at the same time capable of producing such a wonderful and sublime effect on the human mind.

Whoever has, with a susceptible ear, perceived the powerful effect of a large organ, or cast an attentive look on its internal construction, may be induced to ask, who invented this monument of the creative powers and mighty intellect of man? To this question, however, there is no satisfactory answer, for the following reasons:—1st, the organ was not invented in its present form, but originated in some very ancient little instrument, the primitive shape of which but little resembled our present organ, and which, through centuries, has been continually improved and enlarged;—2nd, the first essays in organ building were so insignificant, that people did not think it worth their while to pay them much attention. Besides, the beneficial influence of this invention on the life and civilization of man was at first not so visible and palpable, as was the case with many others which were started at once, showing forcibly and clearly their advantages, as for instance—the invention of gunpowder, the art of printing, &c.;—3rd, the artists of former ages often kept their discoveries and experience secret, however trifling they may have been; others, owing to the imperfect education in those times, were unable to transmit them, by writing, to posterity. This has been the case even with some of the more recent discoveries and improvements; for there are several parts of the organ, and several new contrivances, of which we know neither the author, nor the time of invention. From this it will be evident, that we cannot speak of *one inventor* of the organ, but that several artists share the merit of having, by degrees, produced such splendid works as we now possess.

One thing, which in the history (or rather the origin) of the organ has given rise to manifold errors and conjectures, is the *word "organ"* itself, which is of Greek origin. By taking the word "*organum*," which is identical with our organ, some writers have spread very erroneous notions of this matter. But the Greeks by their *ὄργανον*, and the Romans by their "*organum*," did not mean organs in the modern acceptation of the term, for they were unknown at that time, but an instrument of any kind, particularly a musical instrument. The same may be said with regard to the word *organum*, when occurring in the Holy Scripture (Psalms 137 and 150); for the instruments with pipes, which the Jews had (Magrepha and Moschrokita*), were no doubt quite different from our organs; and when Flavius Josephus (Antiq. Judaicis, Lib. vii. cap. 12) tells us of David having built organs in order to teach the Levites to sing the praise of God, we must not think of organs as we understand the word, but of stringed instruments, one sort of which was called *cynira*, or *cithera* (with ten strings, which were sounded by a quill), and another *nabla*, (twelve strings, played with the fingers.) Besides these, the Jews used in their music great broad basins of brass, called cymbals. These instruments, therefore, had not the least similarity with our organs, and the word organ is a very inadequate term for them.

The organ originated in one of the oldest instruments, the simple *pipe*, which was, according to the Scripture, invented by Jubal, the son of Lamech, from whom are derived the fiddlers and pipers. When, in the course of time, this instrument, on account of its simplicity and monotony, no longer sufficed, experiments were made in placing several such simple pipes, of different lengths, in rows, producing the so-called *Pan-pipe*, (or *syrinx*, from the Greek word *σίριγξ*, pipe.)

The Greek and Roman shepherds made these Pan-pipes of some strong reed, or a suitable sort of wood. They consisted of seven or eight pipes of progressive length, fastened together by wax. Above, where the instrument was put to the mouth, these reeds formed a straight line, and below an oblique one. In emulation with each other, the shepherds soon advanced in their art, and increased the number of reeds to ten or twelve. This Pan-pipe we may properly consider as having, by shape and construction, given the first impulse to organ building; for it consisted of a number of pipes, placed together in rows, according to the succession of tones produced by them, and sounded by the medium of the breath. But the tone of this instrument, though agreeable at a distance, was rough and braying when near, and the mode of playing extremely troublesome, since either the mouth or hand had to be kept in constant motion. To force the wind into the pipes by some other contrivance than by the mouth was a thing which, for centuries, caused much speculation. To do away, at least, with the constant motion of hand or mouth, a small wooden box was invented, containing a number of holes, into which the pipes were placed. A thin tube proceeded from the box, which was placed to the mouth, and the pipes thus sounded. But in this way the pipes all sounded at the same time, producing an insupportable noise, to prevent which it became necessary to cover those pipes that were not to sound with the fingers, a proceeding which was not only very complicated and troublesome, but which at length, when the number of pipes was increased, became impossible. Thus, to prevent the simultaneous intonation of all the pipes, a slide was put under the holes of the pipes, so as either to admit or exclude the wind. The slides stood in an inclined position, and in order to open them, levers were put on, which were connected with the slides by strings. A further increase of the number of pipes made a larger box necessary, and then human lungs were no longer sufficient to afford the requisite wind. Hence, some other contrivance for the production of wind was thought of, and, in consequence, a new sort of instrument, the *bag-pipe*, was invented, (by the Romans called *tibia utricularis*, and by the Greeks, *ὄργανον πνευματικόν,)* into which the wind was conducted through leathern pipes. This contrivance proving advantageous, means were now sought to increase likewise the power of tone. A second row of pipes, producing tones of the same pitch as the first one, was placed in the box. The pipes having been thus increased and enlarged, and the box widened, the next improvement was the enlargement of the tube, or canal, through which the wind was conducted, as the leather pipes, which were liable to collapse, proved now insufficient. This want of sufficient wind led to the construction of *bellows*, by the medium of which it was always possible to provide the tubes plentifully with wind. From this we see that many of the parts of our present organ were already to be met with in these old instruments, though in a less perfect state. The invention of the organ falls, therefore, evidently in this time, though no positive date can be given.

---

* According to traditions, and accounts from Augustine and other old writers, there were, in the 14th century, *two organs* in the Temple of Jerusalem, the larger one of which was called *Magrepha*, the smaller one *Maschrokita*. The former, according to a drawing in Forkel's General History of Music, (Vol. I. Table 4,) must have been a wind-organ. Hieronymus, too, is said to have found there (about the year 400) an organ, the powerful tone of which was heard at the Mount of Olives.

All that can be said with certainty is, that the inventions of which we have hitherto spoken date from the time before Christ.

The bellows in those times (up to the 14th century) were so small and imperfectly constructed, as to be incapable of furnishing an uniform or even flow of wind, and in consequence of this an uneven or unequal tone was produced. Thus, the improvement of the wind apparatus was now seriously thought of, and the result was the invention of the *water-organ*, by the celebrated mechanic Etesibius, of Alexandria, (twenty years before Christ.) In order to produce an equal flow of wind for all the pipes, this man used several vessels, connected with each other, and filled with hot water. The lids closely fitted the openings of the vessels, and could be pressed down by the foot, thus forcing the water from one vessel into another. By this pressure upon the water, and by the corresponding counter-pressure, an equal supply of wind was produced, which was thus conducted to the pipes. The mechanism can hardly be intelligibly described without drawings:—thus much only is certain, that they had pipes, a wind-trunk, a row of keys, and various registers. A great number of large and small works of this kind, and of various forms, was constructed about this time, and even statues received sometimes the internal mechanism of water-organs. The Roman emperors caused such organs to be played during their repasts: they were handled by slaves. Kepler, the famous mathematician, says of the water-organs, that, though they had various registers (see Appendix,) yet they could not be called a praiseworthy invention of the ancients, as they were mere *bag-piping*. The patriarch Tertullian, however, who supposes the above-mentioned Etesibius to be the inventor, and Archimedes the improver of the water-organs, speaks of this instrument in high terms of praise. The passage runs thus:—"Behold the extraordinary genius of Archimedes, as displayed in the water-organ! What a number of parts, conjunctions, canals, registers! and yet but one building. The wind, produced by the pressure of the water, is conducted to every part, a dense mass, divided in its power." Deviating from this, John Ulricus Sponsel (in his History of the Organ, Nuremberg, 1771), maintains that the organ was invented by a barber of Macedonia, in the times of Julianus the Apostate, who died in 361. Vitruvius the architect, and Hero, the mathematician, have made descriptions and drawings of water-organs.

The water-organ being, in spite of its seeming superiorities, yet a very defective instrument, experiments were now made to improve, above all, the awkward and costly wind-apparatus, hitherto used. In this the commencement was made by enlarging the bellows, since two of them were so connected, that in pressing the one down, the other simultaneously rose. This gave the impulse to bellows with *feeders*, which, when strengthened by some weights upon them, furnished a pretty uniform and, in proportion to their size, rather powerful flow of wind. This sort of bellows is still to be found in many small organs. This great improvement on the organ dates from the seventh century.

The first organs were portable, and therefore called *portatives*, (from the Latin word *portare*, "to carry"), in distinction from the larger ones, called *positives* (from *ponere*, "to set down"), which were fixed. The portatives were provided with handles, like our travelling-trucks. The bellows lay in the lower space of the organ, They were chiefly used in theatres and at other public amusements; yet some of these portatives are still to be found in some convents and country-churches.

Centuries passed away before the organ was introduced into churches. England was the first country where this was done, (in 640.) Between the years 669 and 670 Pope Vitalianus introduced them in order to improve the singing of the congregations. The same Pope is even said to have altogether abolished the singing of the congregations and replaced it by that of the canonical singers. Pipin (father of Charles the Great), king of the Franconians, an ardent worshipper of God, was the first who introduced (in 751) the singing and the rites of the Roman Church in France. To elevate meditation, and to accompany and effectually support the singing of the congregation, he sorely felt the want of an organ. But this instrument being at that time not known either in France or in Germany, Pipin applied to the Bizantine emperor Constantine VI., who soon complied with this solicitation, and by a special deputation (in 755 or 756) presented Pipin with a huge organ of lead-pipes, which was deposited in the church of St. Cornelius at Compiegne.*

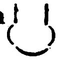
In Germany organs became known under Charles the Great. This emperor caused in 812 an organ to be built at Aix-la-Chapelle, after the model of the organ just mentioned. This organ is said to have been the first that acted without the aid of water. Several writers have expressed themselves in terms of praise on the powerful and yet pleasing tone of this instrument. Georgius, a father at Venice, built in 822 (or 826) an organ for the emperor Ludovic the Pious, with leaden pipes, which was likewise erected in Aix-la-Chapelle. The Byzantine emperor Theophilus (who reigned from 829 to 841), renowned as a friend and patron of the arts, and as a great lover of poetry and music, caused two great gilded organs to be built, which were embellished with precious stones and golden trees, on which, instead of the small pipes, birds were sitting and singing (receiving the wind through hidden tubes.) In the church of the convent of Escurial, near Madrid, there are eight organs, one of which is composed of genuine silver.—Prætorius says, that a certain Duke of Mantua received from a Neapolitan artist an organ, of which the keys, pipes, keyboard, nay even the outside of the bellows, were of alabaster. Lic Ertel, who (in his Atlas of the Bavarian Palatinate) describes the treasures of the chapel belonging to the Palatine, relates, that the organ in this chapel was of ebony and ornamented with many precious stones, the keyboard glittered with pearls, and the bellows were covered over with silver. Though some of these accounts may be exaggerated, yet it is certain that our ancestors spared no expense to render as gorgeous as possible the instrument devoted to the adoration of the Supreme Being.

---

* Constantinus ad Pipinum proficisci jubet legatos, quorum princeps Stephanus Episcopus Romanus. Munera imperatoris, quæ a legatis deferebantur, erant *instrumentum musices maximum*, res adhuc *Germanis et Gallis incognitum*, *Organum* appellant. Gfr. *Aventini* Annales Bavariæ. *Durantus* de Ritib. Eccles. *Casal.* de vet. Christianorum Ritibus. (Constantinus sent a deputation to Pipin, headed by the Roman bishop Stephanus. The present he took from the emperor, was a large musical instrument, hitherto unknown to the Germans and Franconians, and called organ.

Organa fistulis plumbeis Byzanto in Galliam ad Pipinum regem transmissa fuisse dicuntur a Constantia Cæsare.—Alexander Sardus de rerum inventoribus Lib. 1. (The organs with leaden pipes are to be sent from the emperor Constantinus, of Byzantium, to king Pipin, of France.)

In the latter half of the ninth century, such was the progress in organ building and playing in Germany (especially in East-Franconia,) that Pope Johannes VIII. (in 880) begged of a bishop in Freisingen to send him a good organ and a skilful player. Organ builders, too, were at this time invited to Italy from Bavaria. The first great organ is said to have been built at Munich. St. Dunstan (who died in 988,) a prelate in England, cast with his own hand two bells for Abingdon Abbey, and provided (according to William of Malmsbury) this place with an organ also, which is said to have greatly resembled our present organs. This prelate did the same with respect to several other churches and convents in England. At the end of the tenth century, Germany was already in possession of a small number of organs; for Prætorius (in his Syntagma Mus.) relates, that in 944 there were organs at Erfurt, Magdeburg, and Halberstadt. About this time Pope Sylvester II. (who died at Mayence in 1003) is said to have made considerable improvements on the water-organ, which had, up to this time, maintained their ground. In the eleventh century an organ with sixteen keys was built in the cathedral at Magdeburg. From this time we have no sufficient accounts on the progress of organ building. Either such undertakings were suspended on account of the wars, or the zeal in this respect was cooled down and checked by some fanatics, who deemed the use of organs in churches profane.

All the improvements, which finally led to the construction of such organs as were exhibited in the beginning of the seventeenth century, were made in the interval from 1270 to 1520. For we find (in the chronicle of the Alsace, edited by Herzog) that the organs, consumed by fire in 1298, together with the whole Dom at Strasburg, were of a very different construction from the water-organs. Before, and at this time, the organs had not more than nine or eleven keys, a circumstance which at once explains the fact of some of the old hymns having such a very limited compass. The keys at this time were about one yard long, three inches wide (some say even five or seven), and an inch and a half deep, thus occupying a space of a yard and a half. They had this form  Their mechanism was so clumsy and heavy, that the player had to beat them down about *one foot* deep with his fists,—whence the expression organ-beater. Instead of our present action, strings and ropes were used. There was no such thing as a regularly progressing harmony, because the player could beat down but one key at a time, and so produce merely a melody. Alike deficient was the mechanism of the *bellows*. They being very small at that time, every organ had to be provided with a number of them. We certainly must wonder at the perseverance of our ancestors, when we read in old documents and chronicles that the larger organs of this time had frequently twenty and more bellows. Prætorius (in his Syntagma Mus.) says, that the above-mentioned organ in Winchester had twenty-six bellows, requiring seventy strong men to manage them. The organ in Halberstadt had twenty, the one in Magdeburg twenty-four bellows. The bellows had several folds, (like those of smiths,) and were unprovided with weights;—there was no such thing as measuring or proportioning the wind; the power of wind solely depended on the strength of the blower, and, consequently, the wind became unequal, and the tone alternately feebler or stronger. Nor was there a pure or correct tuning of the organs.

In the twelfth century the number of keys was increased; and after this every key received two or three additional pipes, which sounded either the fifth and octave, or the third and tenth. By this alteration the organ was made a mixture, which it remained, until the idea was conceived of partitioning the whole lot of pipes, and giving to the mixture-register a separate slide. In the thirteenth century, the Greek and Latin clergy deemed the use of organs in divine service profane and scandalous. The Greek church does not tolerate the use of organs in churches up to this day.

In the fourteenth century, however, organs were more universally adopted. A Venetian patrician, Marinus Sanutus, a zealous promoter of Christianity, caused, in 1312, an organ to be built, (the first one,) for the church of St. Raphael:—the builder was a German. From this we see, that already the Germans had a reputation as organ builders, which extended far beyond the frontiers of their fatherland; and we shall see, in progress, that the later inventions and improvements in organ-building, almost solely came from the Germans. The organ mentioned above found so many admirers in Venice, that the builder, Sanatus, received the honorable surname of Torcellus, (the organs, at this time, being called Torcelli in Italy.) Monks and the monastical clergy,—the assiduous promoters and preservers of erudition and of the fine arts during the dark time of the middle ages,—not only interested themselves greatly in the erection and decoration of the organs in their churches, but frequently employed themselves with organ building and playing:—so we must reckon them among the most ardent promoters of this art. In 1350, an organ was built by a monk, at Thorn, with twenty-two keys. In the course of this century, some improvements were made on the clumsy and heavy key-board. The keys were made smaller and neater, and their number was increased both upwards and downwards, extending thus over two, sometimes three octaves: besides, a lesser fall was given to them, so that they now could be pressed down with the fingers, instead of with the fists. To the diatonic tones, which were exclusively used hitherto, were now added the chromatic tones, C sharp, D sharp, &c.

In 1359 or 1361, Nicolas Faber, (the oldest organ builder known,) a clergyman, built the great organ in Halberstadt, with fourteen diatonic and eight chromatic keys, extending from B to $\overline{a}$ (see Appendix.) We see from this, that of the chromatic tones the lowest, C sharp, was wanted, as there were only eight chromatic tones. The deepest B stood in front, being thirty-one feet long and 3½ inches (?) in diameter. The organ had four manuals and one pedal, (see Appendix,) for the fists and feet. Twenty bellows, with several folds, furnished the requisite wind, and were blown by ten persons. From this time, large churches were often provided with *two* organs, a smaller and a larger one:—the larger one had generally two manuals, (from F to $\overline{\overline{f}}$,) the upper one for the treble, the lower one for the bass:—this kind of construction very likely led to the invention of our copulas. About this time water-organs gradually disappeared.

In 1426, the Abbi Conradus Winkler had an organ built for St. Ulricus church, at Augsburgh. Germany, in general, was well off at this time with regard to organs; for there were large ones at Solmansweiler, in Suabia, Nuremberg, Breslau, and

Nordlingen. The invention of the *pedal*, in 1470 or 1471, by a German, named Bernhard, organist in Venice, made it now possible to play complete harmonies upon the organ.* From this important invention, by which the organ gained its principal power and fulness, dates a new era in organ building. The eight pedal-keys, however, had at first no separate pipes, but were connected with the deepest pipes of the manual. All these old works had either a short or a broken octave, as we still see in old churches in rural districts, and in some convents. In 1475, Conradus Rosenburger (or Roshenburger) built an organ for the Barefooted Friars' church at Nuremberg, with upper keys of ivory, and under keys of ebony; and in 1493, he built a still larger one, with more keys, for the cathedral at Bamberg. According to some other account, the organ at Bamberg was built in 1475, and enlarged in 1493. The organ in the cathedral at Erfurt was built in 1483 by Castendorfer of Breslau, who also built one (1490) for St. Ulricus at Augsburg; this latter organ cost 107 florins, or £9. The great organ in the collegiate church of St. Blasius at Brunswick was built in 1499 by Henry Kranz. Before the end of the fifteenth century the first large organs stood in the minster at Strasburg, in the cathedral at Halberstadt, and in the two churches at Augsburg. All of them, as may be expected, were provided with pedals.

In the sixteenth century, after the organ had been banished from the churches, as being unholy and scandalous, by the Reformer Ulricus Zwinglius, they were reintroduced in 1508 in the churches of Basel by Simon Sulcer, Dr. Theol. and Professor at Basel. In this century sundry improvements were made, both in the action and in the registers. Instead of the complicated spring wind-chests, where every tone had a separate slide for each register, which frequently required repairing, a German invented the wind-chest, which is still in use. The pipes, too, were improved, and their whole number separated and arranged according as they belonged to their different species, which species was then called a register, and one was distinguished from the other by a particular name, such as diapason, principal, &c. The so-called *stopping* of the pipes, or covering them with a lid, was likewise invented about this time, whereby expense was saved, and that soft, pleasing tone obtained, which open pipes are unable to yield. Thus originated the stop-diapasons, flute stops, &c. By the application of the narrow scale a number of registers with a penetrating yet pleasing tone was obtained, in imitation of the double-bass, the tenor-violin, and other instruments. By the *wide scale,* on the contrary, that full, round tone was gained, which we always hear in good organs. By constructing some pipes with a *narrower end above,* some other registers were added to the former, such as the spindle-flute, the Cremona, &c. Other pipes were made wider at the upper end than the lower, as is the case with the fine stop the Dulcinia, or, more correctly speaking, the Dolcan. In 1590, the octave-flute was invented by Compenio.

---

* This is contradictory to the foregoing account, according to which the organ at Halberstadt (built in 1359 or 1361) had four manuals and a pedal. But as tradition, which asserts Bernhard to be the inventor of the pedal, has the majority of historical testimonies for it, the above statement appears justified.

Even in the course of the sixteenth century some of the reed-registers were invented, imitating the tones of other instruments and of the voice of men and of animals (for instance, the trombone, trumpet, shaum, vox humana, bear's-pipe, &c.) Moreover, by joining to the lips of the pipes the so-called *cheeks,* several registers of a various tone and intonation were produced. It is remarkable, however, that though the improvement of the registers was constantly thought of, yet the very oldest of them, as third, fifth, and mixture, the practicability of which was so often contended, have been retained until this day. In this century the manual was increased to four octaves, only that the lowest octave was seldom or never complete. The tones C, D, F, and G sharp were wasted, and the tones C, D, E, F had a different succession. An organ of this kind was called an organ with a *short octave.* The reason of this singular mode of construction was, either to save space and expense, or, these lower semitones were, perhaps, not deemed necessary. Unfortunately, however, this wretched bungling—to omit certain tones, or to give them a different succession—was practised up to the eighteenth century. In after times the lowest octave was at least so far made complete, that the keys were placed in the proper order, and of the semitone only the C sharp (sometimes D sharp too) was omitted. A still more miserable contrivance was the *broken octave,* where two different keys were placed above each other. In 1570, the organ builder Lobinger, of Nuremberg, inserted the bellows with *one fold*, or *with single action*, which are still used. (According to Muller, the organ builder Hennings of Hildesheim invented these bellows in the seventeenth century.) However uncertain this statement may be, thus much is positive, that this important invention was of German origin. In 1576, an organ with sixty practicable registers and a back-choir was built at Bernan, in the Prussian province Brandenburg. The manuals of this organ had forty-eight keys, from C to $\overline{c}$. The pedal extended from C to $\overline{d}$. This organ, which has been preserved till now, has four bellows, each of which is twelve feet long and six feet wide. The workmanship is masterly, and the whole mechanism bears witness of the great progress in organ building at this time. In 1580, there was an organ in Stendal (Prussian province Saxony), which had forty-eight keys in the manual and twenty-six in the pedal. It contained open and stopped registers, as well as reeds. The builder was John Scheerer. In 1585, Julius Antonio built an organ in St. Mary's at Danzic, which contained the following labial or languet registers: stop-diapason, flute, quintatena, hohlflute, gems horn, nasal, and the registers singing-regal, violin-regal, and Cremona. In 1596, there was an organ in the above-mentioned church at Breslau which had 36 practicable registers, 3 manuals, and 1 pedal. It contained 114 pipes of tin, 1567 of metal, and 53 of wood (making in all 1734), with 12 bellows.

In the seventeenth century several registers were improved, and some new ones—flutes as well as reeds—inserted, among which we may mention the vox humana and the vox angelica (the latter invented by Ratz of Muhlhausen). In 1644, organs were banished from the churches of England. But this nonsensical decree was soon revoked, as the removal of the organs plainly showed the people how essential they were to public worship. The opposite feeling now prevailed, and in order to encourage the use of the organ as much as possible, organ builders of reputation were invited to England from abroad, among others, two celebrated Germans, Harris and Schmidt. In Germany there were at this time several huge organs, some with three, or even four manuals, and a compass of four octaves or more. Although, in the course of time, considerable improvements had been made on the bellows (such as enlarging them and reducing their number), still the *inequality of the wind* was not yet remedied. A German organ builder, Forner of Wettin (near Halle), now invented the *anemometer* (machine for measuring the wind). By the aid of this machine it now became possible to produce, according to necessity, a stronger or weaker, and above all, a uniform wind. The consequence was, of course, an equal *tone*. Hence the bellows were provided with weights. In 1686, A. Schnitker built an organ in the church of St. Nicolas at Hamburgh, with 67 practicable registers, 4 manuals, and a pedal organ, the latter containing, among other registers, a diapason 32 feet in front and a trombone 32 feet. (This work was burnt in 1842.) From 1691-97 the famous Casperini (who is said to have tried to make pipes of hard-pressed paper) and his son built the large organ in St. Peter at Goerlitz, with 57 registers, 3 manuals, and pedal organ, the latter containing a diapason 32 feet in front.

The organs at this time were *tuned* either in the so-called *chamber-pitch* (which at this time agreed with the *orchestra-pitch*), or in the *choir-pitch*, which was a whole tone higher than the former. This latter pitch was more frequently used, because it saved expense, as the pipes, when tuned in the flat chamber-pitch, required to be of greater length, and thus consumed more material. The ancients used the *uneven* or *unequal temperament*, that is, there were only 16 keys upon the organ in which one could play without offending the ear. The other 8 keys (with more flats or sharps, such as E major, B major, A flat major, &c.) could not be used at all, because of their incorrect fundamental tuning, which rendered them insupportable to the ear. It was therefore a very meritorious work of such men as John Sebastian Bach, Telemann, Mattheson, Werkmeister, Fuchs, Sorge, and others, to introduce the *even* or *equal* temperament; for, by effecting the fundamental tuning of the organ as pure and correct as possible, it then became a matter of possibility to obtain in all keys a comparatively pure and correct intonation.*

---

* *Remark of the Translator:*—[Strange to say, this mode of tempering organs *unevenly or unequally* has almost universally been adhered to in England up to this very day. When I spoke to an English organist about this circumstance, he simply told me the reason was this: English organ builders think they would rather have some keys pure than spoil them altogether by an equal temperament. I told him, however, that in organs with an *even* temperament all keys were not spoiled, but all were so

In the course of the seventeenth and in the beginning of the eighteenth centuries great care was bestowed on, and money expended for, the external embellishment of the organ. The whole case was ornamented with statues, heads of angels, vases, foliage, and even figures of animals. Sometimes the front pipes were gilded, silvered, or painted. The lips of the pipes were changed into lion jaws, or some other figures were driven into the pipes. To this paltry sort of artifice we should not object much, the less so, as in the course of time it was abolished as being useless and unsuitable. But people went farther, and threw away the money which might have been expended in a worthier manner, for the most insipid and absurd ornaments, degrading thereby—unknowingly perhaps—this sublime instrument to a raree-show. Among these ornaments the *figures of angels* played a very conspicuous part. Trumpets were placed in their hands, which, by some contrivance, they could move to or from their mouth. Carrillons (chimes), too, and kettle-drums were handled by these angels. Not unfrequently there was in the midst of this heavenly host some bigger angel, soaring above the others in an artificial sea, and beating with his baton the time for his super-earthly orchestra.

---

pure, that even the finest ear would not be offended by the use of any key, because the *surplus* that would arise, if all the intervals were tuned perfectly sharp, is equally distributed among the twenty-four keys in such *very small portions* as amount almost to nothing, or, as are at least imperceptible to the ear. To this he could not reply. I think, however, the matter so important as to deserve the serious attention of English musicians, and organists in particular. Of the many inconveniences and disadvantages of this system of tuning, I will only advert to a few. First.—How is it possible to perform or to accompany on such organs those pieces of church-music, oratorios, masses, &c., which modulate into some of the more remote keys? Second.—How is it possible on such organs to transpose a piece from C major into B major or D flat major, or from F major into E major or F sharp major, and so on?—a thing which is frequently necessary, especially if the organ is not tuned in the proper pitch, or if the compass of the singer or singers is too limited in a certain direction. Third.—How vexing and mortifying must it be to a good organist, when in the course of an improvisation (voluntary) his inspiration and the course of his ideas is constantly interrupted, or even stopped, by the fear of getting into some key where he would produce dreadful discords! I think the real reason why English organ builders and tuners still adhere to this mode of tuning is, not their conviction of doing it better in this way, but their ignorance of the other mode of tuning, combined with an unwillingness and slowness in quitting the old trick-track way, and in stirring their minds for something novel and better.]

Under such circumstances the firmament could not be dispensed with. There were running suns and moons and moving jingling stars (called cymbal stars). Even the host of the animal kingdom was summoned. Songs of nightingales, cries of the cuckoo, &c. adorned the celebration of holy Christmas, and proclaimed to the Christian assembly the birth of the Redeemer. Eagles flapped their wings, or flew towards an artificial sun. The crown, however, of all these absurdities was the *fox-tail.* It was intended to frighten away from the organ all those curious and inquisitive persons who, by thronging themselves round it, often disturbed the organist. Thus, when they pulled out this stop, suddenly a large fox-tail flew into their faces! It is clear that by such absurd wits curiosity was much rather excited than stopped, and that all this host of moveable figures and their ridiculous jingling disturbed meditation, excited the curiosity of the congregation, and thus disparaged the sublimity of Divine service. Another absurd and even pernicious contrivance is the *tremulando,* a register which, on funeral services, fast-days, and on Good Friday, was to indicate the sobbing, sighing, and trembling of men. In praise of the later organ builders, however, we must say that they gradually abolished these absurd and detrimental things, and directed their attention to more important matters, among which we reckon all the improvements on the apparatus containing and conducting the wind. The brothers Wagner were the first organ builders who partitioned the principal *trunk,* so that every wind-chest was furnished with its separate portion of wind. They also introduced separate bellows for the pedal. The latter, however, was only done in large organs, where the pedal contained many and large registers —and then the pedal-bellows produced a stronger wind than those of the manual, in order to produce an accurate intonation of the pedal-pipes.

During the eighteenth century several huge organs were built— works which are still looked on as excellent monuments of these times, doing honour to their authors. In Saxony especially the art of organ building flourished in a very high degree. Here it was the famous Gottfried Silbermann built a great number of excellent organs, and among them several very large ones, as, for instance, the two organs in Dresden, one with 47, the other with 43 registers, and another in Freiburg with 45 registers, all of them with 3 manuals and pedal. In 1702, Theussner finished the great organ for the cathedral at Merseburg, with 68 registers, 5 manuals and pedal. In 1707, Sterzing built an organ in Eisenach, with 58 registers, 4 manuals, and a pedal. Henry Herbst and his son built, in 1718, an organ in Halberstadt, with 74 registers, 3 manuals in front, 2 manuals on the sides, and pedal. From 1721-24 Roder of Berlin built the great organ in St. Maria Magdalena at Breslau, with 53 registers, 3 manuals and pedal, the latter containing diapason 2 feet in front, commencing with G. This G, the largest tin pipe of the organ, weighed 375 lbs., was 25 feet high, and 12 inches wide; it cost 300 florins (£25). In 1725, Joachim Wagner built the organ in the barrack-church at Berlin, with 51 registers, 3 manuals, and pedal. From 1736-50, J. Gabler of Ravensburg (kingdom of Würtemberg) built the great organ for the convent of St. Martin at Weigarten, with 76 registers and 6,666 pipes, the largest of which is of pewter, and holds 32 large pails of water. The pedal contains *three, thirty-two feet* stops (sub-diapason, trombone, and bombardone). From 1750-61, the famous Michael Engel (and after his death his son and son-in-law) built the organ at St. Elizabeth's at Breslau, with 54 registers, 3 manuals, and a pedal, which latter contains a sub-diapason 16 feet in front. It is tuned in the chamber-pitch. The organs in Brieg, Grünsan, and Olmütz, are more or less similar to this one. The organ builder Hildebrandt built, in 1762, the organ in St. Michael at Hamburg, with 60 registers, 3 manuals, and pedal, the latter containing in front sub-diapason 32 feet, sub-base 32 feet, and trombone 32 feet. In other countries also large organs were built during this period. Nic. de Febre built, in 1761, an organ for St. Martin, at Tours, in France, with 53 registers and 5 manuals, the *great organ*, possessing both an open and a stopped register of 32 feet.

The unpleasant bursting or crackling of the reed-pipes, arising from the beating of the tongues upon the mouth-piece when the *leather had got too hard*, gave occasion to the so-called *free vibrating* (or beating through) *tongues*, hereafter described, in which this fault never occurs. The inventor was a German (Kratzenstein) living in Petersburg, under the reign of Katherine II. The first invention of these tongues, however, when they were yet twisted round with wire, must be older than 200 years.

At the end of the eighteenth and the beginning of the nineteenth centuries George Joseph Vogler, the famous musician, composer and organ player (born 1749, in Wurzburg, died 1814) tried to reform thoroughly the whole former mode of organ building, an experiment in which he succeeded to a great degree. His system, aiming at *a simplification of the whole mechanism* of the organ, created great sensation at the time, and found as many admirers as opponents. All that was superfluous, inappropriate, or too costly he endeavoured to do away with. First of all he rendered the action simpler by arranging the keys in their natural succession, in consequence of which the construction of the roller-board became easier and simpler, and the touch lighter. After this he provided the wind-chest more readily with wind, by placing the bellows nearer to it. Then he carried the wind undivided, viz., in a straight line, to the pipes, by enclosing the latter in a case, and by leading the tone upwards, in consequence of which he obtained a more powerful tone, abolished its roughness and harshness, and protected the pipes against damp and dust. He saved also considerable expense by omitting the front pipes, and by availing himself of the so-called by-tones (founded in nature, and produced by vibration), since he connected two registers with each other in such a way, that a third register, which in reality did not exist in the organ, was obtained. For instance, the simultaneous intonation of a 16-feet and a 10⅔-feet register produced at the same time also the tone of a 32-feet, or the combination of an 8-feet and a 5⅓-feet that of a 16-feet. Vogler's system was adopted in several places, and even now some organ builders make use of it.

Although by the choice of registers the tone of the organ could be rendered mellow to a certain degree, still the transition from *forte* to *piano*, and *vice versâ*, by drawing out or pushing in some registers, was still too unconnected and interrupted to satisfy a good organist. To make the organ a perfect instrument a *crescendo* and *decrescendo* were wanted. In the beginning, therefore, of the present century, Kaufmann, of Dresden (Professor of Mechanics and

Acoustics), an artist of great merit and a profound thinker, invented the so-called *compression-bellows,* by which he obtained from the pipes with free vibrating tongues a beautiful *crescendo* and *decrescendo.* He also made experiments with flue-registers, which sometimes, especially with smaller pipes, turned out satisfactorily. In large organs, however, such a contrivance would not only be very difficult, but would also be unlikely to prove satisfactory, as an increased or decreased pressure of the wind influences the intonation of the flue-pipes, that is, it makes them sound higher or lower. Of the truth of this assertion we can easily convince ourselves on small organs with single-action bellows. Music-Director Wilke, however, in the musical journal called "Cecilia," throws out some hints how flue-pipes too may be sounded by compression-bellows, without raising, by a moderate increase of wind, the tone. Another invention to obtain a *crescendo* and *decrescendo* by the medium of the so-called *swell* was made in 1809 (or 1811) by the Frenchman Grénié, who called his instrument *orgue expressive.* It consists of a single register with free vibrating tongues, extending from F to $\overline{f}$, five octaves. The wind is produced by four bellows, of which two and two are joined together. The player himself blows them by treading alternately upon two pedals, which are connected with the bellows by a lever. The tone can gradually as well as suddenly be increased to the highest degree of power, and imitates the hautbois or the clarionet, the English horn, and even (especially in the lower notes) the ophicleide. Most striking is the imitation of the bassoon. There are three different sorts of swells used in organs. 1. The *roof* or *door swell.* Here the wind-chest is enclosed in a box, the inside of which is lined with cloth, felt, or frieze, materials by which the tone is absorbed. The lid of the box is moveable, so that by a sort of handle it can be opened more or less, the consequence of which is, a louder or a more subdued tone. This swell, when accurately constructed (of oak wood), is the best sort. 2. The *Venetian swell.* This is the only sort used in England. Here the pipes are enclosed in a frame provided on all sides with Venetian shutters, which, by a contrivance, the player can open more or less, according to pleasure. 3. The *wind swell.* Here the ***trunk*** is provided with a valve of velvet (or some other material of silk), which may likewise be opened more or less. This sort of swell is not recommendable.

That contrivance by which an organ may be *transposed* higher or lower is not indeed a new invention, but it has been greatly improved, if not entirely altered, by the brothers Bernhard. To lead, instead of using the *purse*, the wire through the plates of steel or brass, is said to be an older invention, whereas the screw-key (now used in tuning the reed-pipes instead of the tuning-crook) is an invention of our time. In the mechanism of the bellows also many improvements have been made. Among these we reckon the so-called *articular bellows* (probably the same as what the English call single-action bellows), which are very easy to be handled, hold twice as much wind, require no auxiliary weights, and occupy so little space that they may be placed in the organ itself. This latter proceeding, however, we should only advise in cases of absolute necessity, though it has its advantages, the trunk being very short, the wind is not weakened by a long passage—not to mention the cheapness of such a contrivance. Besides this, bellows have been constructed, the upper board of which lifts up entirely, thus producing twice as much wind as common bellows of this sort. To such bellows any form or shape may be given, according as the size or form of the bellows-chamber requires it. In smaller organs these bellows have been so constructed, that each upper part (or the bellows in opposition to the feeder) is supplied by *two feeders* (double-action bellows), which can be drawn up by a sort of handle. Experiments of another kind made in our time, viz., to make the bellows act by steam, will, though feasible, hardly meet with approbation, as, in the neighbourhood of so many combustibles, fire is a very dangerous thing, and the cost of a steam-engine, with its maintenance, together with the expense of a person to superintend it, will always exceed the salary of an organ-blower.

In 1830, the organ builder Beyer, of Nuremberg, invented an 8-feet reed-register, which he called *clavaoline*. It consists of small tongue-pipes of brass, each of which is placed in a small block of wood standing upon the upper board. These blocks, which thus correspond with the foot in reed-pipes, have small holes, through which the wind passes to the tongues. The tone of this register is similar to that of the Jews' harp. The same builder built, in 1832, an organ, in which the valves are not pulled down, but raised up on their back end to the grooves, by the medium of a lever opening them at their front. Another invention of reed-registers, similar to that of the clavaoline, was advertised in the "Breslau Gazette" (May, 1833), by the watch-maker F. Benke, who engaged himself to construct trombone-registers, 16, 32, or even 64 feet, in the most limited space, so that they could be placed in the smallest organ. He presumes the height of a pipe producing the lowest C of a 16-feet to be only *one yard*, of which 3 inches only would belong to the body of the pipe itself. He asserts, too, that such reed-registers would never get out of tune. (?)

One of the most recent inventions is the so-called *duplicate system*, mentioned in the "Universal Musical Gazette" of Germany. It was brought out by an organ builder, whose name we have reason to keep secret. The mechanism is nearly as follows:—every register produces *out of* itself another register only an octave higher upon another manual, or it produces an independent register which may be used in connection with another manual. This is effected without any copula, and thus renders the construction of an additional manual very cheap. An organ with three manuals, one of which is the duplicate-manual, would not cost more than one with two manuals, though the effects produced would be quite the same as if there were really three. The mechanism of the manual-copulas is the same as in other organs. The so-called *octave-copula*, invented by Buchholz, of Berlin, is different from this system.

The continual rise in the price of materials, and sometimes want of room, made organ builders think of a simpler mechanism, and of a less expensive disposition of the organ. Thus, the pipes of two different manuals have sometimes successfully been placed upon the same wind-chest (as was done, for instance, by Buckow, in Hirshberg). The organ builder Müller, in Breslau, placed in a small organ for a country church the only pedal-register (sub-bass, 16 feet) upon the wind-chest of the manual. This organ has, however, a pedal-copula to replace the wanting pedal-registers. Experiments were made to use other materials. Thus the organ builder Marx, of Berlin, built (1818-20) an organ with six registers, the case of which was of cast-iron and the pipes of zinc. The use of

German silver instead of pewter is also new. There is a contrivance in the organ at Eisleben which is worthy of imitation. Here the pipes of the diapason and principal are provided at their mouths with a sort of box (capsule), whereby the tuning of these pipes is greatly facilitated and the bending of them avoided. Not long ago improvements in the pedal have been made also. The lower keys were constructed with tumour-like elevations in the middle, so as to facilitate the alternate use of the heel and toe of the foot. The newly invented *auxiliary key-board* in the pedal, which is described by the inventor, Scheide, in his work on this subject, is likewise most excellent.

The *literature* of organ building has been greatly enriched of late. Besides the many little treatises on this subject, we mention the following works (mostly new) as the most important ones. Küking, "Theoretical and Practical Handbook of Organ building." Topfer, " On the correct Proportion of Mensurations and of Wind-conductors, and on the Mechanism, Preservation, and Tuning of the Organ." Scheibler's writings (1838) on the Musical and Physical Mensuration of (the) Tone, and its application to Piano and Organ Tuning. Wilke's works. Schlimbach's work on this subject, newly edited by Becker.

The organs built since the commencement of the present century have generally complete octaves in the bass, and a greater extent in the higher octaves. The manuals generally extend from C to $\overline{\overline{\overline{f}}}$, the pedal from C to $\overline{d}$. Among the more important works built during this time, we may mention the following:— 1. The colossal organ in London (called Apollonicon), on which six organists can play at the same time. The builders were Flight and Robson; it cost £10,000. 2. The magnificent organ in the cathedral at Breslau, built by Janeczeck and Müller (the latter of Breslau), with 60 registers and 3 manuals; the description of this organ is given at the end of the book. Müller has built several organs with 16 to 33 registers, as likewise some very large ones: for instance: (3) The great organ in St. Elizabeth's at Breslau, with 54 registers. His son, Robert Müller, built, in 1839, (4) the organ in the Protestant church at Warsaw; and in 1833, (5) the organ in the Music-Hall of the Breslau University. Both works are excellent in every respect, and have frequently been mentioned in the musical papers of Germany. The same master built an organ with 7 registers, 2 manuals, and a pedal, which was, after his own invention, so constructed, that all the registers of the manuals could, singly as well as collectively, be used in the pedal also. Every register had two different stops. This organ is now in Schlawentschütz. 6. The organ at Perleburg, built by Turley, with 36 registers, cost £340. 7. The organ at Salzwedel, by the same maker, with 42 registers. 8. The great organ in St. Paul's at Frankfort, built in 1833, by the famous Walker of Ludswigburg (kingdom of Wurtemberg), with 74 registers. 9. The colossal organ in St. Peter's at Petersburg, built in 1841, by the same builder. Both of these organs have 2 pedals each. 10. The great organ in Kronstadt (Transylvania), built by Buckholz in Berlin. 11. The organ in St. Mary's at Wismar, by Schulze. 12. Theorgan in Salzwedel, with 40 registers, by Meyer. 13. The organ in St. Niclas at Zerbst, with 37 registers, by Zuberbier and Geibel. 14. The organ in St. Augustin at Gotha, with 34 registers, by Schulze. 15. The organ in the collegiate church at Trebnitz, with 33 registers, by Müller jun. and sen. 16. The organ in Katscher (Silesia), with 20 registers.*

---

* In this the author has chiefly enumerated the large organs in the north of Germany; but there are many others, with from 20 to 40 registers, in the south of Germany, which he of course is unacquainted with.—*Remark of the Translator.*

PART I.

EXTERIOR OF THE ORGAN.

CHAPTER I.

THE ORGAN CASE AND THE POSITION OF THE FRONT PIPES.

THE organ being an essential ornament to the church, is usually rendered as handsome as possible. The organ builder embellishes the case of the organ by juttings and wainscots of every description—by columns, heads of angels, foliage, &c.—by a handsome varnish, and by more or less costly gilding. Besides this, he places those pipes which stand in front of the organ so as to form a variety of graceful figures, such as we see in *Table I, Fig.* 1. In these various positions the pipes are not arranged according to the order in which the tones follow each other upon the key-board, but according to the rules of symmetry, or else the row of front pipes would have to begin with the smallest and to end with the largest. Commonly the front pipes are so arranged that the tones C, D, E, F sharp, G sharp, and A sharp stand on one side, and the rest of the tones on the other (*Table 1, Fig.* 2). Sometimes the largest pipe stands in the middle, and the smaller ones on both sides, diminishing gradually in size (*Fig.* 3). These are things which an organist must know, in order to be able to see immediately how these front pipes correspond with their respective keys on the manual or pedal. That wind-chest upon which all the C pipes are placed is called the *C wind-chest,* whilst the *C sharp wind-chest* bears all the C sharp pipes.

CHAPTER II.

ON KEY-BOARDS IN GENERAL.

Every organ has two different rows of keys, called key-boards; the one managed by the hands, and hence called "the manual," from the Latin word *manus*, "the hand;" the other managed by the feet, and called "the pedale," from *pes*, "the foot." The upper keys of the manual are commonly veneered with bone or ivory, the under keys with ebony.* Bone is better than ivory, because the latter gets in the course of time yellow, and gives the key-board a bad appearance, besides its being dearer than bone. The pedal-keys are generally made of oak. The succession of tones is the same on the manual as on the pedale, except in some older organs, where the succession of tones in *the lowest octave* is different, both in the manual and in the pedale. Here the tones seem to begin with E, followed by F, F sharp, G, G sharp, &c. But this is not the case, for the semitones C sharp, D sharp, F sharp and G sharp are wanting altogether. The key E sounds the tone C; F sharp sounds D, and G sharp sounds E. Thus, F lies between C and D, G between D and E. From A upwards the succession of tones is the same as in the higher octaves. (See *Table I, Fig.* 4.) Of an organ of this kind we say it has a *short octave*, an expression also applied to those organs where, in the lowest octave, only the C sharp (or C sharp and D sharp) is wanting. Another arrangement in old organs is called the *broken octave*. Here the tones in the lowest octave follow in the same order as in the short octave; but here are *two additional* tones, F sharp and G sharp, the keys of which are sharper than the under keys, yet lower than the upper ones. The key F sharp lies above D, and the key G sharp above E, as we see in *Table I, Fig.* 5. By these contrivances the old organ builders intended to save space and expense, and as they tuned their organs always in the unequal temperament (where the more remote keys cannot be used) the semitones C sharp, D sharp, F sharp, and G sharp could be better dispensed with.

---

* In England ebony is usually used for the upper keys and ivory for the lower ones.

The manual is generally placed in the middle of the front of the organ, but want of room or some other circumstance renders it sometimes necessary to place it on the side, or even behind the organ. This latter position is of course the worst, because the organist cannot see the clergyman, nor can he conveniently use a mirror for this purpose. There are organs where the manual does not seem to be at all connected with the organ, as it stands on a separate case (back choir). Here the whole of the action lies beneath the floor of the organ. Some organs have two, some three, some even four manuals; they are placed above each other, so that the lowest of them projects more from the organ-case than the others. In organs with *two manuals*, the lowest is commonly called the *great organ* or principal manual, because it contains the greatest number of registers: the upper one the *choir organ* (sometimes the *swell organ*). If, however, the pipes of the upper manual stand behind the back of the organist, as is sometimes the case, then that part of the organ is called a *back choir*. These back choirs should, if possible, be avoided, for they intercept the view into the church, limit the room for the choir, prevent the tone of that part of the organ which stands behind them from penetrating into the church, and are difficult to get at in case of a repair being necessary. For organs with *three manuals*, the *middle one* is generally the *great organ*, the *upper* the *swell organ*, and the *lower* the *choir organ*. (The organ in the cathedral at Breslau is an exception: there the lower manual is the great organ, the middle one the swell organ, and the upper one the back choir.) The key-board of the pedale is enclosed in a frame, which is screwed to the floor. A great number of small organs have no pedals, whilst some organ builders now begin to provide large organs with even *two* rows of pedals. The fact of there being several manuals gave rise to a very erroneous distinction between whole organs (organs with four manuals), three-quarter organs (with three manuals), half-organs (with two manuals), and quarter-organs (with one manual). It is evident that every organ, no matter how many manuals it has, or how small it may be, is *complete*, as soon as the registers it contains are properly proportioned, and manual and pedale have the requisite compass.

CHAPTER III.

ON THE STOPS IN GENERAL.

On both sides of the manual, or sometimes above it, there is a number of handles or buttons projecting from the organ case, made of wood or iron, by means of which the player is enabled to produce, according to his judgment, a loud or a soft tone: they are called *stops*. In order to show the player at once the character of the stops, all of them are provided with a label, which states the name of the stop and its size in feet (or, in mixtures, the number of pipes for one key). The general contrivance is such, that the player must draw out those stops which he wants to sound; but on some organs these stops must be pushed sideways or inwards, whilst those that are not to sound must be drawn out. The manual and the pedale have each separate stops.

CHAPTER IV.

ON THE ENTRANCE TO THE ORGAN.

The interior of the organ is shut up either by doors with fastenings, sliding boards, or shutters which fit the corresponding holes in the frame of the case. These boards are easily removed, by being either lifted up or pushed sideways a little. Sometimes they are fastened by screws, which must first be drawn before the boards can be removed. A more minute description we cannot give, because every organ builder has his own mode of constructing these parts of the organ. But the organist must be well acquainted with all this, so that he knows the purpose of every screw, nail, or peg; for it frequently happens that persons unacquainted with the way in which organs are shut up, when they want to get to some part of the interior in order to remedy some fault, they lose a deal of time in getting the case open, or they are at last obliged to force it open, in consequence of which they often break or spoil some part of the organ case.

PART II.

CHAPTER I.

THE BELLOWS AND WIND-CONDUCTORS.

The organ is in many things like the human body. The bellows of the organ have the same functions as the lungs of the body, and the various vessels in the organ which conduct the wind correspond with the various pipes of the body which conduct the air. There are three sorts of bellows:—1. *single-action bellows.* Here two bellows (or rather a bellows, in the more narrow sense of the word, and a feeder) are so connected with each other, that the one lies above the other. The lower one, called the *feeder* (because it feeds or supplies the upper one with wind), when pressed down, produces the wind and leads it immediately to the upper one, which must of course rise. This kind of bellows is generally very small, and therefore used in small organs or barrel-organs chiefly. They are not to be recommended, having almost as many faults as the second kind of bellows, which are called (2) *double* or *triple-action bellows* (or even more actions), because they have two, three, or more of such feeders. When blown, these bellows form two, three, or more *folds*, and are thus similar to our blacksmiths' bellows. The faults of these bellows are, that when they are drawn up, and the various folds open, the wind receives a kind of shock or sudden force, and thus becomes stronger, while when the bellows sink and the folds close, the wind becomes feebler. Besides this inequality of wind which they produce, they are also frequently out of repair, since by continual opening and closing of the folds the leather soon wears out. These two kinds of bellows are, as far as the translator could gather, principally used in England. It is doubtful whether the third kind of which the author speaks, and to which he gives the preference, is much known in England; he calls them (3) *one-fold,* because they *form* but *one* fold in sinking. They are more simply constructed, very durable, and furnish a uniform wind. The size and number of them depend on the size of the organ. Their length (varying from six to thirteen feet) is commonly twice their width, but some organ builders deviate from this proportion. Walker made the bellows of the great organ for St. Petersburg thirteen feet long and only five feet wide, whilst those of the organ in Halberstadt (built by Herbst) are nine feet long and five feet wide. Similar proportions are sometimes made necessary by the locality of the organ, and particularly by the size and form of the bellows-chamber.

A couple of bellows of the latter description consist first of an *upper* and *under-board.* Both must be made of good dry fir or pine wood, an inch and a half thick. To prevent the warping of the wood, these boards are provided with ledges running across. The under-board rests upon what is called the "*lug.*" Between the upper and under-board there are six boards, viz., two shorter ones at the end of the bellows where they open, called *end-ribs;* and four longer ones, two on each side of the bellows, called *side-ribs.* In *Table I., Fig.* 6, *a* is the upper end-rib, *b* the lower end-rib *c* the upper side-rib, *d* the lower side-rib. The connection of the ribs with the upper and under-board is thus: the four inner edges of the under-board have holes bored *downwards* in an oblique direction, whilst the adjoining edges of the side-rib, immediately lying above, have holes bored *upwards* in an oblique direction. In each hole of the under-plate is put a horse sinew, a few inches long, which must be freed from all fat, well dried, and washed in lye. This horse sinew is fastened to the under-board by a wooden peg dipped in glue. The upper end of the sinew is put in the hole of the adjoining side-rib, and fastened in a similar way. The adjoining sides of the ribs among each other, as well as the upper-board with the upper edge of the side-rib, are all connected in a similar manner. In this way the bellows are provided all round with horse sinews, whereby the upper-board, ribs, and under-board form a whole. The sinews are, however, not placed at equal distances from each other, but are nearest where the bellows open widest and are most strained. Over the whole of the sinews good strong white dressed leather is glued, and the bellows are thus closed up on all four sides. Instead of horse sinews, brass hoops are sometimes used. The other ends of the bellows (where they open widest), called the *hinges,* are provided with a double or tripple leathering, because the action of the bellows is here strongest. To prevent the escape of wind, the boards and ribs of the bellows are (before they are covered with leather) varnished with glue and bole; or they are glued over with parchment or strong paper. In the same way the knots in the wood are covered with leather, to prevent their falling out. In the middle of the under-board is a square opening intended to let in the air. This opening (see *Table I, Fig.* 8, *a, b, c, d*) is surrounded by a frame which is screwed on to the under-board. In the middle of the frame is a ledge or beading (*e*), dividing the opening into two equal parts. Upon this ledge there are two valves, of which the one opens to the right, the other to the left, into the interior of the bellows (*f* and *g*). This whole contrivance is called the *sucker*. A similar contrivance is on the front of the bellows, where the principal trunk begins. Here is a square box, called the *wind-box* (or wind-trunk); provided with two valves, which open into the great trunk, so as to let the wind pass from the bellows into the trunk. These kind of valves are called *wards* (see *Table II., Fig.* 1, *e*).

The upper-board has on its end (where the bellows open) a prolongation, about half a yard long and a quarter of an inch wide, in the form of a fork, called the *bellows tail.* (In large bellows there is sometimes a beam screwed over the whole length of the upper-board). The fork of the bellows tail has a round hole, so that between the two shanks a strong ledge, called the *pusher,* can be drawn. This pusher is a few inches deeper, and twice or thrice as wide, and has likewise a wide hole. Through this hole, and the holes of the two shanks of the fork a strong iron bolt is put to connect the pusher with the upper-board. The pusher, hanging thus vertically on the upper-board, has on its lower end again a hole. This lower end goes through the slit of a strong beam, called the *bellows pedal* or *handle,* which is again kept together by a strong iron bolt. These two bolts, connecting the pedal or handle with the pusher, and the latter with the upper-board, are provided with a linch-pin, to prevent them from falling out. The bellows pedal rests on a still stronger beam, which is fastened to the floor. Where the pedal comes in contact with this beam, the latter has a deepening in the form of a half-circle (called the *pan*), made of strong iron, in which the pedal moves up and down. On some organs this pedal must be moved by the feet, in others it must be managed by the hand (and then it is of course called the *handle*). Sometimes the bellows are drawn up by strong leather straps, which run over wooden rollers. On the length of the bellows pedal or handle depends to a great degree the amount of the blower's work—the longer the lever the easier the work.

Since the air in the bellows, to increase its force, requires some pressure, the upper-board of the bellows receives some auxiliary weights, as the weight of the bellows themselves is not sufficient. For this purpose stones are used. To make these auxiliary weights act immediately the bellows begin to sink, the upper-board must be lower at its back end than at front, so that when the bellows are at full height the upper-board forms a horizontal line. Any other construction different from this is inappropriate, for if the bellows rise *too high*, the pressure of the auxiliary weights cannot begin before the upper-board has sunk so far as to form a horizontal line, and when the pressure begins to act, a stronger wind is produced than before. To avoid this inequality of wind, and to obtain an equal pressure upon the bellows, another contrivance is made use of, as follows:—Below the front end of the bellows lies, upon the floor, a small block of wood, upon which a ledge is fixed, about three inches wide, an inch and a half thick, and long enough to run over the whole length of the under-board and to project a little over the end of the pedal or handle. Into the upper end of the pusher a wooden peg or iron hook is driven, and round the back end (which hangs free) of the ledge a rather strong rope is bound, the end of which is fastened round the peg or hook. Thus, if the bellows rise, and have reached their medium height, the pusher bends and draws the ledge upwards, which had been lying straight. The elastic power of this ledge acts till the bellows has sunk again to their medium height. In this way the *ledge effects the same pressure when the bellows are above their medium height, as the auxiliary weights do when the bellows begin to sink below this medium.* This ledge is called the *bellows spring*. All bellows are not provided with this spring; on some it lies above, instead of below the upper-board.

To understand the mechanism of the bellows better, we must look at the large figure on *Table II.* Here *a a* is the upper-board of a pair of bellows, which are drawn up; *b b* is the under-board with the sucker; *c* is the upper, *d* the lower side-rib, *e* the wind-box with the wards; *f* the bellows tail; *g* the pusher, connected with the tail by a peg *n; h h* is the bellows pedal or handle, which rests with its peg at *o* upon the beam *p*, and is connected with the pusher by a peg at *u; i* is the bellows spring, tied at *q* to a rope *v*, which is fastened to the pusher at *r; t* is the little block of wood on which the spring rests; *k* the ledges upon the boards of the bellows, *l* the box with the auxiliary weights. The dotted lines indicate a frame, with another couple of bellows upon it, which are, however, not drawn up.

The action of the bellows and the functions of their different parts are as follows:—By treading the bellows pedal (or by pressing the handle) down, the pusher rises and lifts up the upper part of the bellows. During this little interval the outward air has pressed upon the sucker, which, in consequence, has opened, in order to let the air into the feeder (lower part of the bellows). The air in the feeder now presses the sucker upon its frame, so as to close it and to prevent the air from escaping. The auxiliary weights, together with the bellows spring, then press the upper part of the bellows down, in consequence of which the pusher and pedal are both sinking. Whilst the upper part is sinking the wards open and let the wind pass from the bellows into the principal trunk with its different branches, from whence it passes into the wind-chest. From the latter the wind passes through the palates into the grooves or bars, then through the slides into the upper-board, and from thence into the pipes. All these parts of the organ will be hereafter described.

The above-mentioned wards play a most important part in the mechanism of the bellows. They are the cause of the phenomenon which is observed in good new bellows. If the several bellows are drawn up, they must not simultaneously, but successively, sink again, or else the blower would not be able to afford sufficient wind, especially when the full organ is used. This inconvenience is avoided by the wards in the following way:—As soon as the last pair of bellows has been drawn up, the first one begins to sink. The wind emanating from this latter pair immediately fills the trunk and all the other conductors of wind. The wards of the other bellows are, by the force of the wind (contained in the last pair) kept closed, until all the wind has passed from the sinking pair into the trunk. Now the next pair of bellows begins to rise, emptying in the same way, and keeping the wards of the next pair closed, until all the wind is gone. This is repeated with every next pair, until the turn comes again to that pair which was drawn up first, and so on. These wards serve also to prevent the wind in the trunk from passing back into the empty bellows.

As (as we have already said) the *equality of wind* is such an important thing, it is necessary *to examine closely the force of wind.* The wind supplied by *one pair of bellows* must be as strong as the wind supplied by all the bellows together. The number of bellows is not to increase the *force* of the wind, but merely its *volume.* If an organ with 4 bellows has 40 degrees of wind, then every one of the bellows must produce 40 degrees. In order, therefore, to obtain this equality of wind, and to determine the weights with which each bellows must be provided for that object, *the wind must be measured* or *weighed.* For this purpose the *anemometer* (or wind scales) is used. This is a measure (see *Tab.* 9, *fig.* 1, *a*) of about the size of a half-pint, commonly composed of pewter, and closed on its upper end by a lid (*b*) of the same material. Upon this lid, near the edge, is soldered a pewter tube, bent at right angles (*c*). A second, short tube, of the same material, and likewise soldered upon the lid, rises opposite the larger tube (*d*). In this shorter tube there is a glass barometer (*e*), about 5 inches long, to which is fastened a scale as on the thermometer, with the degrees numbered (*f.*) The scale is divided into four inches, and the latter are subdivided into 10 degrees each, making 40 degrees altogether. Above and below (on the points *g* and *h*) the scale is fastened by wire. In using this instrument the lower measure is first filled with water, till the latter reaches the tube (*d*). To prevent the water from running out, the lower end of the barometer is twisted round with flax. The principal trunk in every organ contains a hole, which is closed by a large cork. This cork must be drawn out, and then the end of the longer tube (*c*) is placed into the hole of the trunk. If the hole should be too small, it must be widened, and if it be too wide, the end of the tube must be carefully twisted round with flax, leather, or some other material, to keep it air-tight. To make the whole instrument stand perfectly still—which is very necessary, because the slightest trembling of the hand would produce an inaccuracy in the calculation—two small boards, between which the machine is placed, may be fastened to the trunk. Every thing being properly prepared, *one pair of bellows is gently drawn up.* As soon as it begins to sink, the wind that passes from the bellows into the trunk, presses through the hole on the water in the weighing machine, and drives part of it into the barometer. It must then be examined at what number the water in the barometer stands when it has reached the highest point, or, in other words, what degree of power the wind has. After this has been ascertained, and the degree remembered, *another pair of bellows is examined in the same way.* Suppose now the second pair of bellows furnishes less power than the first, then the water in the barometer will, of course, reach a lesser height. In this case the second pair must be provided with auxiliary weights, until the scale shews an equal degree with the first pair. Should, however, the second pair produce a stronger wind, the weight must be diminished. In this way all the bellows are gradually equalized, and finally all are tried together, when it will be found that they have exactly the same degree of strength as each pair of bellows by itself. This investigation requires, of course, more than one person, to be properly accomplished.

The author here gives the description of a newly invented anemometer; its inventor was Professor Toepfer of Weimar, who in 1843 published a work on the organ, in which he describes his newly invented instrument. This machine consists of a brass box (see *Tab* 9, *fig.* 2), the basis or area of which is oval. About half an inch above the basis rises a supplement (*figs.* 3 and 4, *h*). Upon this supplement stands a kind of wall with round grooves, into which the glass tubes (*figs.* 2 and 3, *a*, *b*) are placed. This wall reaches, in the interior of the supplement, almost down to the ground (about as far as the dotted line in *fig.* 4 shews). Both tubes stand in little capsules, into which they are cemented. The tube *a* passes above into a cylinder (*fig.* 3, *t*), which, by an opening, communicates with the interior of the box. The upper opening of the cylinder is closed, as it only serves for an occasional cleaning of the glass tubes *a*, *a*. The glass tube *b* passes above through a ring, which prevents it from breaking. The scale for measuring is so constructed, that it may be moved up or down; it is 4½ inches long, and divided into four principal parts, which are again subdivided into 10 degrees each; *e d* in *fig.* 2 are supplementary tubes, by which the whole machine may be put into the hole of the trunk, either on the sides or on the lower end of the machine. Both these tubes are precisely of the same diameter, so that one bore will fit them. Of course, if one of them is used, the other must be closed. As soon as the wind passes from the trunk into the tube *a*, and presses upon the water, the point *o* of the moveable scale will be of the same height as the level of the water in the tube *a*. The level in the tube *b* then shows the size of the stratum of wind. This kind of weighing-scale has the advantage that it can be applied to the trunk on the side, as well as below, whereby many inconveniences and inaccuracies in the whole transaction may be avoided. Finally, a door (*fig.* 3, *f*) protects the tubes from liability to injury.

Whenever the wind is not properly proportioned, that is, if one pair of bellows produces a stronger wind than another, *the organ cannot be correctly tuned*, for a stronger wind makes the pipes sound sharper, a weaker wind flatter and less clear. Besides, if the wind be too strong, the pipes oversound (or produce the higher octave of the tone they ought to sound), and if the wind be too weak, the pipes do not speak or sound promptly and distinctly; nay, the larger ones do not sound at all, or very slowly. Of these we must, of course, except those registers which have *naturally* a slow intonation, as the gamba, the violin, &c. The strength of the wind depends on the size of the organ and the number of registers. An organ with numerous registers, among which there are some very large ones, requires a very powerful wind. This is particularly requisite in organs where the pedale, containing 16 and and 32 feet registers, has its separate bellows.

How many degrees of wind an organ is to have (these degrees vary from 20 to 40), cannot be determined, as the division of the scale on the anemometer is not the same with all builders and in all countries. The principal thing in measuring or weighing the wind is, not to ascertain the number of degrees, but *to obtain an uniformity in the various pairs of bellows*, so that they all furnish an equal or uniform wind. In the same way *the number of bellows* which an organ is to have cannot positively be determined, as the size of the bellows differs very considerably. Of course, the larger the bellows, the lesser number is required. A larger number of small bellows is sometimes required when the bellows chamber is very limited. In this case two or three small bellows are laid above each other. Large bellows are always better than small ones, as they hold the wind longer, and as they need not be drawn up so often, they require less repair. Large organs with 3 or 4 manuals and from 50 to 70 registers, have (according to size) from 8 to 16 bellows; organs with 2 manuals and from 16 to 50 registers, have from 3 to 8 bellows; and smaller organs with one manual and from 8 to 16 registers, have 2 or 3 bellows; a *small organ should never have less than three pairs*, because, if, in the first case, *one* pair is damaged and becomes unfit for use, the whole organ becomes useless; for, though there be one good bellows left, the playing would be interrupted as often as the one rose. But if there are three bellows, two of them will do the service, if the third be damaged.

CHAPTER II.

THE WIND-CONDUCTORS AND STOPPING-VALVES.

The canals through which the wind is conducted (hence called wind-conductors) are, on their four sides, enclosed by strong boards of pine or fir, and, in order to render them perfectly air-tight, the inside of the boards is varnished with a pulp of glue and bole; the knots and knags in the wood are glued over with leather, or they are better taken out and the holes plugged. The principal canal, which is immediately connected with the bellows (as has already been described) and is thus the first vessel into which the wind passes from the bellows, is called the *trunk*. The principal canal has *partitions* (or branches) going the length of the canal, each of which has again a separate conductor to lead the wind to the respective parts of the organ. *The trunk has as many partitions as the organ has manuals.* For instance, if there are three partitions, the one of them conducts the wind to the registers of the great-organ, the second to those of the swell-organ, and the third to those of the choir-organ. From this it will be clear that these partitions cannot be of equal size, as, for instance, the one for the great-organ must be larger than that for the swell-organ, because it has to supply a greater number of registers. Smaller organs have generally but two partitions, one for the manual and the other for the pedale. In large organs, however, where there are divided wind-chests, every manual requires two of these partitions, in order to have always sufficient wind for the divisions of the wind-chest. In the same way the pedale, when there are several wind-chests for it, must have several partitions also.

In some organs every partition of the trunk has a *valve*, which, by a sort of stop, can be opened or shut, so as either to allow the wind to pass into the organ, or to prevent it. These valves are intended to remedy the so-called *howling* or *sounding-on* of certain pipes, when their respective keys are not pressed down. The contrivance is this: for the insertion of the trunk, or rather partition, is a small board, which closely fits the opening of the partition. This board is trimmed with leather, so as to prevent the escape of wind, and is kept down upon a kind of frame by metal springs. By pulling out the corresponding stop, which is connected with that board, the latter removes from the frame and admits the wind into the organ, whilst, when the stop is pushed in, the board occupies its former place again and stops the entrance of the wind from the bellows into the partition. Hence these valves are called *stopping-valves*—for organs with only one manual these valves are almost useless, as by stopping one partition, the playing will be stopped altogether (because such an organ has only one partition). The only advantage is, that by this valve the howling of a pipe can be stopped at once. In organs with two or more manuals, however, stopping-valves are indispensable, and here, when one manual becomes unfit for use by the stopping of one partition, the other manual or manuals may be used. Where these valves are wanting, the howling of certain pipes can only be remedied by pushing in gradually the stops, until the noise ceases. It is evident that this latter proceeding would greatly disturb divine service. Larger organs are, however, mostly provided with these valves. In some organs every manual is provided with *two* of these valves, as, for instance, the great organ in St. Elizabeth's at Breslau. Here every wind-chest has *two divisions*, each of which requires a stopping-valve. The pedale of this organ has four of these valves, viz., two for the reed pipes and two for the labial pipes (or flue pipes). It is usual, however, in all large organs, for the reed registers and the labial registers of the pedale to have each their separate stopping-valves. This is a very good contrivance, for, if one of the reed pipes should howl, and the valve for the reed registers be stopped, the player would have at least *one* species of pipes (the labial pipes) left at his disposal. It might be objected that, in case the reed registers of the pedale were exclusively used (the labial registers having been stopped, in order to remedy the howling), the character of tone in the pedale would differ too much from that of the tone in the manual. To this we reply, that in large organs the wind-chest for the reed registers of the pedale always bears *one* labial register (8 or 16 feet tone), the effect of which lessens to a great degree the difference in the character of the tone. If the organ also has a pedale-copula, then the objection is altogether removed, because in that case all the *labial-basses of the manual can be coupled to the pedale, so as to counterbalance the ascendancy of the reed-basses.* Sometimes, however, the howling or humming of the pipes arises from causes which the stopping-valves would be unable to remove. Suppose one of the keys in the pedal sticks, moving neither up nor down; in this case all the pipes of the various pedale-registers, corresponding with that key, would sound or howl; and, if the pedale be coupled, all the respective pipes of the various manual-registers would sound also. Now, as these pipes stand upon various wind-chests, and as the wind-chests are supplied by various partitions of the trunk, it would be in vain to stop one of these partitions by the stopping-valve; but the only remedy would be to undo the pedale-copula, and to push in all the pedale-registers, so that the pedale could not be used at all. Further remarks on similar faults and their remedies will be found in the later chapters.

CHAPTER III.

THE GREAT SOUND-BOARD.

The great sound-board (*Table III., figs.* 1, 2, 3, A) is a wind-conductor, which receives the wind from the trunk and conveys it to the sound-board or wind-chest, with which it is closely connected. The great sound-board and wind-chest are of equal length, but of unequal width; they form together, as it were, a whole. Both must be made of dry oak, and rendered perfectly hermetical, which is effected by varnishing the inside with glue or bole, or by lining it with strong paper or parchment. The great sound-board (*fig.* 1, *a*, *b*, *c*, *d*) is divided into three, four, or more partitions according to its length, by strong boards of oak, which run parallel with each other through the width of the great sound-board. These boards are parted in the middle, so that the wind can pass from one partition to the other. These passages to the several partitions are closed up by a sort of bung or valve, which are on their edges, covered with white dressed leather, so as to fit accurately. In case the *palates* (see the following chapter) in the wind-chest should require looking after, these valves (*f*) may be taken out, in order to make this part of the organ accessible. As great heat in summer makes the wood shrink, it might happen that the bungs were driven out by the force of the wind. To prevent this, they are each provided with two wooden or iron bolts (*g*) near the ends of the bungs. The bolts are on their upper end fastened by a nail or pin, so, however, that they may be moved to the right or left. On their lower end the bolts have a cut, which fits the head of a nail (*i*), towards which the bolts are pushed, when the passages to the different partitions are to be closed again. Some great sound-boards have, instead of the bolts, iron screws (*k*). In order to take the bungs out, they are provided either with iron rings (*l*), or with slings of strong hempen cord (*m*), or with handles (*n*). As in very hot weather the bungs shrink, whilst in damp weather they swell, a new sort of bung is to be recommended. These are planed off in an oblique direction, towards the interior of the great sound-board, and roughly covered with leather, so as to fit closely the edges of the G sound-board, the latter being planed off and covered with leather in the same way. Thus, if in hot weather the wind passes through the crevices of the bungs, which is perceived by a whizzing sound, it simply requires the wooden wedges (*p*) between the bolts (*o*) to be driven up a little, when the bungs will fit closer, and the whizzing cease. To remove these bungs, it is only necessary to remove the bolts.

CHAPTER IV.

THE PRINCIPAL VALVES OR PALATES.

We have already spoken of various sorts of valves; but those called *palates* are the most important ones, because they are immediately connected with the keys of the manual and, pedale, and open for the wind a passage to the pipes. The palates are little boards of good, dry oak, about six inches long and one inch thick (*figs.* 2 and 3). They are in the great sound-board, and serve to shut up the grooves (see the following chapter) in the wind-chest (*figs.* 2 and 3, B). Without these valves the whole mass of wind in the great sound-board would simultaneously enter all the grooves, and thereby sound all the pipes, standing on the wind-chest. As the grooves are not all of the same width, but narrower for the higher tones and wider for the lower ones, so the palates are not all of equal width, but vary according to the grooves. To close the grooves perfectly, the palates must of course be about a quarter of an inch wider on all sides than the groves. The lower side ends in a pointed edge, so that the palate, in opening, cuts easier through the wind, a thing on which the lightness or heaviness of touch on the key-board to a great degree depends. The palate is glued on to the great sound-board by a strip of leather, or it moves in a peg of metal (*fig.* 2, *a*). This latter contrivance is the better one, because it greatly facilitates the removing of the palate. On the two sides of the palate there are two other metal pegs, driven into the great sound-board (*fig.* 3, *a a* and *fig.* 2, *b*), to prevent the palate from moving to the right or left, the consequence of which would be the howling or sounding of some pipes. These two side pegs must be sufficiently long, lest the plate, in opening, should go over them and allow the wind to pass to some of the pipes and make them sound. After one of the manual or pedal-keys has been pressed down, and the palate in consequence opened, there is an elastic spring which forces the palate back to its former position, so as to shut the groove up again. This spring consists of a metallic wire, which has spiral windings in the middle, and ends in two shanks (*fig.* 4). The upper shank of the spring rests with its bent end in a hole, which is in the under side of the palate. In opening the palate, this upper shank sinks down into a sort of kennel, which runs along the lower side of the palate. The lower shank of the spring proceeds from the spiral windings and turns to the bottom of the great sound-board. Its pointed and crooked end rests in the hole and cut of the ledge (*fig.* 2, *g*), which is fastened to the bottom of the great sound-board, and is as long as the wind-chest. On the two sides of the lower shank of the spring there are two pegs (*i*) driven into this ledge, to prevent the spring from moving sideways. In *fig.* 2 the spring is already placed under the palate. The springs must all be of equal strength, lest one key should have a heavier touch than the other. Where an inequality in this respect exists, it may be somewhat remedied, by placing under the spring a second one. With the palates for the manual this might be called bungling, but with the palates for the pedale, double springs are very necessary to make the palates fit well; and as these pedal-palates have much harder work to do than the manual-palates, every pedal-key is generally provided with an additional key under it, so as to spare the strength of the pedal-spring. On the lower end of the palate, and in front of the upper shank of the spring, there is a sling of iron or metallic wire, in which hangs a hook, almost in the form of an S (*fig.* 2, *c*, *fig.* 3, *b*). In the lower part of this hook hangs another wire in form of a hook. The lower end of this latter wire goes through a hole in the bottom of the great sound-board, and is connected with the keys of the manual and pedale in such a way, that the player, by its means, can open whatever palate he chooses. To prevent the wind from passing through the same hole, through which the last-mentioned wire passes, the hole has, on the side where it turns towards the bottom of the great sound-board, a hollow in form of a basin. Over this hollow is glued a piece of white leather in form of a purse, and therefore called the *purse,* which covers at the same time the entire hole (*figs.* 2 and 3, *e*). That part of the bottom of the great sound-board, upon which these bags or purses are glued, is called the *purse-board* (*figs.* 2 and 3, *D*). Every wire which is to go through a hole of the purse-board is led through a small wooden tube, about two inches long and a quarter of an inch wide (*figs.* 2 and 3, *d*). This tube is first cut in two halves, of which the shorter one is pushed forward, so as to reach the hook on the palate. The wire is now pierced through the middle of the purse, and the larger half of the tube glued on to the purse. In this way the two detached parts of the tube are merely separated by the thickness of the leather purse. The wire going through the purse is called the *purse-wire.* The lower part of it, lying outside the great sound-board, is called the *pull-down* (*figs.* 2 and 3, *h*), and is, by means of a tracker (*k*), connected with a key on the manual or pedale.

Instead of purses, plates or strips of brass are sometimes used, with holes in them, through which the wires are led. This contrivance, which is not new, contributes, according to Toepfer, much towards maintaining a light easy touch, since it removes the friction and resistance caused by the purses. Besides, the frequent repair of the purses is by this contrivance obviated; only care must be taken that the wire passes perfectly vertical through the holes in the metal plates, so as not to cause friction, whereby the holes in the course of time would be enlarged, and permit the wind to pass through them. The opinion of the organ-builder Muller of Breslau is decidedly in favour of brass plates; in building the large organ for the cathedral at Breslau, in 1801, he used metal plates throughout for the manual wind-chests, but purses for the pedal. When, in 1833, this organ was tuned a semitone lower, Muller found all the purses more or less destroyed, whilst the metal plates have lasted until the present time. He therefore invariably now uses strips of brass or pewter, which are as long as the wind-chest, and about an eighth of an inch thick. These strips are fastened on, and in order to secure them effectually, the edges are covered over with a small wooden ledge. The wire he uses is of the same sort as the strings of a pianoforte. Muller thinks pewter better suited for this purpose than steel or brass, because it does not rust or gather verdigris. Rust may occur indeed with the wire, but not on the place where it goes through the tin plate, because the two planes coming in contact here are perfectly smooth, and the frequent motion of the wire does not allow the latter to rust. And even if this should take place, the wire is easily replaced by a new one. But however accurately this contrivance may be executed, the holes would still be enlarged by the continual friction. Should this happen, Muller replaces the old wires by new ones, which are one degree thicker than the old ones; and should still some wind escape, or a whizzing sound be heard in the great sound-board, we must console ourselves with the consideration that, as leather is so very porous, the purses are much worse in this respect, and that the loss of wind is much greater with them. Muller has tried to put all the palate-wires, belonging to one manual, into one common hole, bored in the great sound-board; the result was such a trifling escape of wind as amounted almost to nothing. It must further be mentioned that, in contrivances of this kind, parts of the same material ought never to be used, because they occasion a friction, which, though perhaps inconsiderable in the beginning, will turn out injurious. Thus, if the plates are of metal, it is better to make the wires of iron or steel;—for steel plates, metallic wire, and for tin plates, steel or metal wires are used. Music-Director Wilke rejects metal plates,—1. because metals of the same kind, especially wire running in plates, destroy each other sooner;—2. because steel wires rust and occasionally stop the action;—3. because some wind must be lost, even when the wires and plates are new; 4. because leather purses are easier and cheaper to construct. Finally, we must remark that in some organs the wind-chest for the pedale, especially when there are several large registers standing on it, has two palates, which sometimes lie behind, sometimes beside each other, and open from their opposite sides. This is the case, for instance, in an organ at Breslau, though the pedale has only eight registers, and the whole organ only twenty-five. This is done to obtain for all the pedal-registers a uniform wind, and a good, prompt intonation; this mode of construction is, however, a little more expensive. There are, moreover, organs which have but one wind-chest for two manuals; here too, double palates are made use of. In other organs, the two lowest octaves have likewise double palates, one for the manual and the other for the pedal-copula. The palates of back choirs are not in a horizontal, but in a vertical position (*Table V, fig.* 2, *f.*)

CHAPTER V.

THE WIND-CHEST.

The wind-chest or small sound-board, which bears the pipes of the organ, is a sort of square box of good dry oak. Its inside is varnished with glue, and every imperfect place is covered with leather so as to render the whole air-tight. It consists, first, of the side boards, which are from four to six inches high, and from an inch to an inch and a half thick. The length of the wind-chest depends on the compass of the key-board, its breadth on the number of registers standing upon it. In the middle, and on its two ends, the wind-chest rests upon strong beams, to which it is fastened by iron bands, &c. These beams must be very strong, as they have to bear such great weights, and as the slightest sinking of the wind-chest would produce the greatest disorder. The interior of the wind-chest is, breadthways, divided into as many partitions as the manual or pedale, for which it is intended, has keys. These partitions are called *grooves*, and the ledges (about an inch thick) by which they are separated, *tables* (see *Table III, fig.* 5, *A*). The grooves are of equal length, but their width depends on the corresponding pipes, so that the larger pipes have wider, the smaller ones narrower grooves. Thus every groove holds exactly as much wind as is necessary to sound either a large or a small pipe. The organ-builder must of course accurately proportion the size of the grooves according to the size and number of registers; in this point he can best show whether or not he is a perfect master of his art. If the grooves are too small, the pipes of the lower octaves will sound very slowly and imperfectly, or, in quick passages, not all. Besides, the pipes cannot, in that case, keep on either their proper intonation or their correct tuning, as the strength of the wind constantly varies during the playing. The upper board of every groove contains as many holes as there are registers standing upon the wind-chest; for instance, if the wind-chest bears twelve registers, then the upper board of the groove has twelve holes. The holes belonging to one register are separated from those of another by wooden ledges (*Table III, fig. 5, c*), which run lengthways through the wind-chest. The holes are not bored in so as to form a straight line, but in the way seen in *fig. s;* this is done to save space. The size of the holes depends on the corresponding pipes. The bottom of the wind-chest lies partly beyond the great sound-board, and partly forms the cover of the latter. Now, as the grooves are all over the wind-chest, and as some part of this bottom lies beyond the great sound-board, it is a matter of course that the grooves in this latter part of the wind-chest must be stopped by some sort of valve, or covered with parchment. On account of the pedal-copula, the two lowest octaves of the manual have double palates. The number of wind-chests depends on the size of the organ, on the disposable room, and on the judgment of the organ-builder. An organ with one manual only requires but a simple wind-chest, though there are organs of this kind where the wind-chest is partitioned; but as manual and pedale have each its own action, all organs with a pedale must have a separate wind-chest for the pedale. If, however, the pedale has only one register (such as double-diapason 16 ft., or bourdon 16 ft.), and on the rest a pedal-copula, to compensate for the want of pedal-registers, then that single register may as well be placed upon the manual wind-chest, in order to save space and expense. With two or three pedal-registers this could hardly be done, as it would greatly impede the access to some of the pipes, in the event of a little fault having arisen. Hence the wind-chests must be so constructed as to allow an easy access, especially to the palates. For this reason, organ-builders generally allow a moderate space between the wind-chest of the manual and that of the pedale; the former wind-chest is usually more in front of the organ, whilst the latter stands more in the back. But if in a large organ a pedal-diapason stands in the front of the organ, then there are sometimes a few other pedal-registers immediately behind that diapason, instead of manual-registers. In organs with two manuals the wind-chest for the great organ stands generally in two partitions on the two sides of the organ, whilst the wind-chest for the choir-organ stands in the middle of the organ, or that part of it which is called the back-choir. In organs with three manuals the wind-chest for the great organ stands generally divided on both sides of the organ, that for the choir-organ in the middle, and that for the swell-organ in the back-choir. If there is no back-choir, the wind-chest for the swell-organ stands immediately below or behind the wind-chest for the great organ. Every organ-builder having his own system, little can be positively said on the number and position of wind-chests. If there is room enough, it is of course better to place the wind-chests behind than below each other, as, in this latter case, some of the registers would be too much concealed, and thus become ineffective.

CHAPTER VI.

THE UPPER-BOARD.

The pipes do not immediately stand in the holes spoken of in the preceding chapter, which are bored into the upper sides of the grooves. This would be impossible, as the slides move just below the feet of the pipes. There must thus be a contrivance by which the pipes stand firm and fixed, though the slides immediately below them are moveable. This contrivance is called the *upper-board.* There are several such boards, varying from one to three feet in length and breadth, the latter depending on the size of the pipes which are to stand on them. Their depth is from an inch to an inch and a half or more. They are of oak or lime-wood; the latter sort of wood is not recommended, because it is too soft, and is more liable to warp. We have already spoken of the ledges, which separate the holes for one register from those of another;—a row of pipes standing lengthways upon the wind-chest is called a register. These ledges are the third of an inch thick and broad, and as long as the wind-chest. They are glued upon the upper side of the wind-chest, and fastened with wooden pegs. Upon this ledge are fastened with iron screws, the various upper-boards; the worm of the screws being first dipped in tallow, to prevent rust (see *Table III, fig.* 5, *b*). The upper-board of one register does not consist of one piece, but is cut in some four or five pieces, partly to prevent the warping of the wood,—as a shorter piece of wood does not warp so soon as a large one of the same thickness, — partly to save taking out all the pipes of a register, when some fault is to be remedied; these single pieces of the board are, however, placed closely together, so as to make them appear one. Below the upper-boards are the *slides* (see the following chapters). Above, each of these upper-boards has as many holes as the manual or pedale has keys. The hole in the upper-board is exactly above the hole in the upper part of the grooves. For the different kinds of mixtures, sesquialteras, &c., where one key has from two to five pipes, or even more, there are, in the upper side of the upper-board, as many holes as the key has pipes. At the lower side of the upper-board, however, these various holes run together into one, so that the various pipes for one key of a mixture-register are supplied with wind by only one hole in the grooves, just as though there were only one pipe for a key. In these holes of the upper-board the pipes stand. With reed pipes there is a small difference in this, which we shall see in some of the following chapters.

Sometimes the front pipes do not stand upon the upper-board; but the upper-board contains a number of holes, from which tubes project, into which the pipes are placed. These tubes are called *conductors* (*Table III, fig.* 5, *a*). They are either of pewter, brass, or wood, and vary in width according to the size of the pipes. They are provided with leather on both ends, so as to fit closely and to prevent the wind from escaping. Sometimes, for want of room, a part of the pipes belonging to one wind-chest must be put on a separate auxiliary wind-chest, and here the conductors have the same function as with the front pipes.

To understand all this better, we must now look at *Table III, fig.* 5. This figure represents the wind-chest of a manual in three different positions; *A* are the *grooves; b* the *upper-boards,* upon which the pipes are shewn by circles, squares, and dots; at *b* the upper-boards are screwed upon the *ledges* of the wind-chest; the *conductors* (*a*) supply the diapason with wind; at *C* we see the *slides* (*d*), which are separated by boards or ledges (*c*). In older organs there are sometimes two slides beside each other, as we see here at the two upper ones.

For the shorter pipes, which stand but loosely in the holes of the upper-boards, there are some small additional boards, a little above the upper-boards (*Table III, fig.* 6). These small pipes go first through the holes of the *pipe-holders*, as they are called, and thence into the corresponding holes of the upper-board; by this means they obtain a firmer stand. The larger pipes, on the other hand, are provided with hooks, which fit into a peg driven into a ledge behind the pipes; or sometimes this ledge, or *leaning-stock* of the pipe, has a semi-circular cut, into which the pipe leans back, so as to gain a firm and fixed position. There are various other contrivances, some of which are very bad, to make the pipes stand firm. A person who undertakes to remedy some fault, and has for this purpose to take out any of the pipes, must first clearly ascertain by what contrivance the pipes are made to stand firm, or great damage might be done.

PART III.

THE ACTION.

CHAPTER I.

THE SLIDES.

The *slides* are ledges of good, dry oak, about two or two and a half inches wide, and one third of an inch thick. Their length depends on that of the wind-chest, so that on the end of the wind-chest, where it is connected with the stops, the slides are always about two inches longer than the wind-chest. There are as many slides in the wind-chest as the latter bears registers. If the organ-case is closed, the slides cannot be seen, as they are below the upper-boards (*Table III, fig. 5, c*), and have only as much space allowed them, as is necessary to pull them in or out by means of the stops. The slides are prevented from moving sideways, and are separated by small ledges, called *tables*. The slides and tables stand equally high, because, if the slides were standing higher, the upper-board would lie so heavily upon them, that the drawing of the stops would become difficult, if not impossible. *Fig.* 7 represents a slide (*a a*) moving between the tables *b b* and *c c*. Every slide has as many holes as the key-board belonging to the wind-chest, in which the slides are, has keys. These holes vary in size, according to the pipes standing above them (*fig 5, d*). By pulling the stops out, the slides connected with them are drawn out also, and occupy such a position, that the holes in them stand precisely below the holes in the upper-board, and above the holes in the *grooves*. If a key on the manual or pedale be pressed down, the palate moves from the opening of the groove, and admits the wind from the great sound-board, first into the groove, then into the hole of the slide, whence it passes into the holes of the upper-boards, and finally into the pipe. By pushing the stop in again, the slide returns to its former position, where it prevents the wind from passing out of the groove-holes into the holes of the upper-board. To prevent the slides being drawn out too far, they have, near the end, a small cut or ridge (*fig* 7, *f*), only large enough to contain the strong square iron pin (*d*), which is here driven into the wind-chest. This pin must be driven in so far as to stand exactly as high as the tables upon the wind-chest When the stop is drawn out, the slide moves on until this pin catches the cut of the slide, and then the slide is forced to stop. In this way it can never be drawn out beyond this limit. On the one end of the slide (*a a*) there is a square opening (at *e*), through which the upper end of the *lever* passes (see the following chapters). To prevent the wind escaping through the little crevice between the slides and the upper-boards, the upper part of the wind-chest, between the tables upon which the slides move, is covered with white sheep leather, which is burnt through on all the places where the openings of the grooves are.

As partitioned wind-chests require also partitioned slides, and as the parts or partitions of the latter must move simultaneously, they are connected by longer or shorter ledges, which are almost as broad as the slides, but stronger. These ledges are called *coupling ledges* (*Table IV, fig.* 1, *c*); they are between the two parts of the slide, and connected with them by screws or nails (*a a* is the slide, *f f* are the screws or nails). In the middle of every coupling-ledge is a cut, into which the upper end of a lever (*b*) fits. This lever is on its lower end connected with a pusher (*e*), and the latter again with a stop; this will be farther explained in the following chapters. At *g* the lever *b* rests in the cut *d*. The coupling-ledges must be of strong oak; sometimes iron brackets are substituted for them.

CHAPTER II.

THE CONNECTION BETWEEN THE SLIDES AND STOPS.

What slides are, has already been explained. Stops are the handles or buttons, which project from the organ-case near the key-board. Every organ has as many stops as it has slides, but there are some small organs, with only one register for the pedale; here this single register is constantly used, and requires no separate stop to be drawn out or pushed in. The mode in which slides and stops are connected is different in different organs, and with different builders. In small organs the contrivance is nearly as follows:—The continuation of the stop is a square oaken pole, called the *hand-draw stop*, which goes to the interior of the organ. The inner end of the pole is cut out in form of a fork, and catches the horizontal arm (called the trundle) of a *roller* (see *Table IV*, *fig*. 2, *a a*). This arm is of hard wood or iron, and a few inches long (*fig*. 2, *b b*). The roller is of oak, proportionately thick and planed off on its eight or six sides. It moves in two iron pegs (*c c*), of which the one is driven into the upper, the other into the lower end of the roller. The arm and the fork of the hand-draw stop have corresponding holes, through which a screw is put, or an iron peg, without a point, and bent at right angles, which then connects the roller with the hand-draw stop. On the upper end of the roller there is a second horizontal arm, which is connected by an iron peg with the end of a short pole called the *trace*, this end being likewise cut out in form of a fork (*fig* 4). The trace is of oak, a few inches long, and one or one and a half inches thick. The other fork-like end of the trace seizes the lower end of what is called the *lever*. This lever is a ledge of oak about one foot long, two or three inches broad, and half an inch thick, with a hole in the middle. The several levers, which stand on one and the same side of the wind-chest, are kept in a row together by a strong iron pole, which serves as a sort of axle, round which they move. To prevent their turning sideways, they move in a sort of sheath (see *Table IV*, *fig*. 5). The upper end of the lever goes through the square hole in the inner end of the slide.

In organs with two manuals, where the two partitions of the wind-chest for the great organ stand on both sides of the organ, and the wind-chest for the choir organ in the middle, the connection between the slides and stops is thus effected:—The end of every hand-draw stop that belongs to the great organ seizes one of the arms of a horizontal roller. The other arm of this roller catches a trace, which goes to the opposite partition of the wind-chest of the great organ, and there joins the lower end of a lever, the upper end of which is directly connected with the slide. At some small distance above the trace there is a coupling-ledge, running parallel with the trace, and likewise connected with the lower end of the above-mentioned lever. This coupling-ledge goes back to the opposite partition of the wind-chest, and there seizes the lower end of a lever, the upper end of which is directly connected with the slide.

Sometimes the mechanism is as follows:—The hand-draw stop seizes the lower arm of a vertical *angle-hook* (*Table IV, fig.* 6), the upper arm of which catches the lower end of a trace. These angle-hooks are of different size; the smaller ones are sometimes made of iron, to render them more durable, but the larger ones always of hard wood, otherwise they would be too heavy. The several angle-hooks move in the cuts, which are made into a sort of ledge, called the angle-hook ledge (*fig.* 7). Where the shanks of the angle-hooks meet, there is an iron rod which connects the angle-hook with its ledge, serving the former as an axle. The upper end of the above-mentioned trace is connected with the horizontal arm of an iron angle-hook, the second arm of which is driven into a horizontal roller. On the lower end of the roller there is a strong wooden arm, which goes through the hole in the middle of a coupling-ledge, so that the latter may be moved to the right or left. Both ends of the coupling-ledge are connected with the lower ends of the corresponding levers, one of which catches the slide. The choir organ has generally the same mechanism in this respect as ordinary small organs, which we have already described. If, however, the choir organ stands above the great organ, then the hand-draw stop receives the lower arm of a vertical angle-hook, the upper arm of which seizes the lower end of a trace, which runs up between the coupling ledges of the great organ, and joins the arm of an iron angle-hook. This hook is in the lower part of the roller. On the upper part of this roller stands a second angle-hook, the horizontal arm of which seizes the lower end of a lever, whilst the upper end of this lever is connected with the slide.

In organs with three manuals, the mechanism of the great and of the small organ, is, with little deviation, the same as has been previously described. But the choir organ stands either behind or below the wind-chests of the great organ, or it forms (especially in older organs) what is called the back-choir. The mechanism of back-choirs is simpler, if they themselves contain the stops, but more complicated if the stops of the back-choir are on the great organ, where all the other stops are; because, in this case the whole of the action-work lies beneath the floor of the organ. In the former case, the hand-draw stop seizes the upper end of a vertical lever, the lower end of which receives a trace, which joins the horizontal arm of a vertical roller. The other arm of this roller is by an iron hook connected with the slide. In the second case, the hand-draw stop receives the one arm of a horizontal roller, the second arm of which is connected with a trace. This trace runs along below the floor, and seizes one of the arms of a vertical roller, which stands in the back-choir. The other arm of this roller is directly connected with the slide. If the back-choir consists of too separated halves, and has consequently divided wind-chests and divided slides, the mechanism is as follows:—The roller, which is connected with the hand-draw stop, has a third arm which seizes a trace. This trace goes to the opposite part of the organ, and there joins the upper arm of a vertical roller. The lower arm of this roller is connected with a trace, which runs below the floor on to the opposite half of the back-choir, and there seizes one of the arms of the roller, the second arm of which joins the slide.

The action of the pedal-organ differs more or less from this, accordingly as the wind-chests of the pedale lay on a level with or lower than the wind-chests of the manuals. In small organs, where these two kinds of wind-chests lay equally high, the hand-draw stop generally seizes the lower arm of a vertical roller, the lower arm of which is connected with a trace. This trace receives the lower end of a lever, which catches with its upper end the slide. In larger organs, where the wind-chests of the pedal-organ stand generally lower than those of the manuals, or sometimes on the same level, the hand-draw stop is connected with the upper arm of a vertical roller, the roller with a trace, and the trace with the lower arm of a second roller. The lower arm of this roller receives a trace, which joins the lower end of a lever. This lever finally completes the connection with the slide. Sometimes, in wind-chests of this description, the hand-draw stop is connected with the lower arm of a vertical angle-hook, the upper arm of which receives a trace. This trace goes upwards, and catches with its upper end an arm of the horizontal roller. The other vertical arm of this roller goes through a hole in the coupling-ledge, whereby the connection with the slide is effected. *Table IV, fig.* 11 represents an ordinary common action.

CHAPTER III.

THE ACTION OF THE MANUAL AND PEDAL-ORGAN.

The keys of the manual are enclosed by a frame of oak, the smaller part of which lies outside, the larger one inside the organ. Where the veneered part of the keys ends, a ledge lies above them, which is a few inches high and crosses the whole key-board. The lower edge of this ledge is lined with leather, cloth, or felt. A similar ledge lies below the keys to prevent them rattling. For the lining of this ledge, leather is the best material, because there is no danger of its being damaged by moths. The end of every key moves in an iron or brazen peg or pin, which is fixed in the frame of the key board. In some new organs the keys rise on their back end when they are pressed down, as is the case on the piano. These pegs are covered over by a ledge, so that the keys cannot be thrown out. This ledge is likewise fastened to the frame. Besides this, every key moves between two pegs in the front ledge, to prevent its turning sideways. Above the front ledge, and going a little deeper, is a board, which is on both sides screwed on to the organ-case, and upon which the music stand is placed. If this board is removed the roller-board becomes visible. Sometimes the rollers themselves are not visible at once, because they lay in the interior of the organ behind the roller-board, and sometimes, instead of the rollers, trackers are seen, which go up to the wind-chest of some other manual. In this latter case, the roller-board is replaced by a roller-frame. This roller-board consists of several boards joined together, and very nearly adjoins the wind-chest to which it belongs. It is almost as long as the wind-chest, and rests with its lower edge on the two side-ledges of the manual frame, or on separate blocks of wood, which are glued upon that frame. Upon this roller-board there are above each other end, in a horizontal direction, as many iron or wooden rollers as the key-board contains keys (see *Table IV, fig.* 11). The length of these rollers varies; their depth is about one or one and a half inches. On both sides of the roller are two strong pegs of iron, which move again in another wooden peg (*Table IV, fig.* 8) glued to the roller-board, to prevent any contact of the rollers with each other, or with the roller-board. The connection between the rollers and the key-board is as follows :— Immediately behind the front-ledge of the key-board, there is upon every key a screw-worm of brass wire, proportionably strong and a few inches long. From the roller belonging to a certain key, a roller-arm proceeds, and goes beyond the back end of this key. The end of this arm catches the hook of a thin pole called the tracker, which is about half an inch thick and of various length. To the lower end of the tracker a wire is fastened, which forms on its lower end a sort of sling. To prevent the sling unclosing itself from the screw-worm, the latter is provided with a *socket* of strong leather. Thus if the key is pressed down, the tracker, and with it the roller-arm and the roller itself, will be moved too. On the other end of the roller is another arm, just at the place where, straight above that arm, its corresponding palate in the great sound-board is situated. In the hole of this second arm hangs another tracker, which catches with its upper hook the hook of the pull-down. This pull-down connects the palate with its corresponding key, in the way described in PART II, CHAP. IV.

Now we must look at *Table IV*, *fig.* 11. *A* is a part of the key-board, *B* the trackers, *C C* the roller-board with its rollers. *D D* the great sound-board, with the purses below and the palates above, *E E* the wind-chest, *F F* the slide lying below the upper-board *G G*. Besides this, we see the action of the register. *H* is the lever, which is connected below with the trace ~~*F F*~~, and above with the slide *F F*; *K* is the roller, the invisible arm of which catches the trace. The other arm *N* receives the hand-draw stop *M*, with the handle or simple stop *L*. I I

Such is the mechanism in small organs. The rollers lying above each other, the trackers of course cannot be of equal length. In order to prevent the shaking or clashing of the longest trackers, a kind of comb is provided, wherein they move. These longer trackers, which lay horizontally, are prevented from bending downwards or sideways by vertical wire tacks. Instead of the roller-board, there is in some organs a roller-frame, which lies horizontally. Here both the rollers are not above but beside each other. In organs with several manuals roller-boards and roller-frames are made use of. Sometimes the latter are perhaps preferable, as the boards of which they consist are smaller than the roller-board, and consequently less liable to warp. Besides, a damaged roller is easier to be taken out of the roller-frame than from the roller-board. Wilke proposes to enclose the roller-boards by frames, in order to prevent the warping of the wood.

In organs with partitioned wind-chests, and with roller-frames instead of roller-boards, we often meet with the following mechanism:—Beneath the manual (*Table V, fig.* 2, *a*) there are two frames lying above each other (*b* and *c*), containing the rollers which run parallel with the manual-keys. The rollers in the one frame are designed for the C wind-chest, and those in the other for the C sharp wind-chest. At the front end and above these rollers there are iron angle-hooks (*d* and *e*), standing horizontally, but in an opposite direction, so that one shank of these hooks turns to the right, the other to the left. The front end of the horizontal shanks is hammered broad and provided with a hole. Immediately below the manual there is a sheath (*f*), in which (a kind of) *prickers* are placed (*Table IV, fig.* 9). These prickers are small pieces of wood a few inches long and one third of an inch thick. They touch, with their upper ends, the manual keys. The lower end of them is provided with a screw-worm, and the latter with a socket. Every pricker stands with its screw-worm in the hole, which is contained in the front end of one of the above-mentioned angle-hook shanks, and in which it is kept fast by a socket. At a small distance from the angle-hook stands a corresponding roller-arm vertically upon every roller. To the latter a tracker is fastened, which runs horizontally on to the respective wind-chest. Here the tracker joins the vertical arm of a roller, upon this roller there is again an angle-hook, from which another tracker proceeds, which goes to the great sound-board, where it is connected with the corresponding palate. In the figures at the end of the book, which explain this mechanism, the trackers appear to be broken in two.

In those key-boards where the keys rise with their back end if they are pressed down, the keys are not connected with the rollers below them, and with the corresponding angle-hooks, by prickers, but there are below the back end of the keys, adjusting screws with sockets, by which the sling of a tracker-wire is secured. This sling catches the angle-hook of a roller. Thus, in pressing the keys down, the angle-hooks are not pressed down, as in the case of the prickers, but raised up. On the rest the mechanism is the same as above. (*Table V*, *fig.* 9, *e*, and *fig.* 3, *d.*)

In some organs there is, immediately above the manual, a kind of mechanism which looks very much like a second manual. Here are as many levers, called *blind keys*, as there are keys. The levers and keys are connected by a screw-worm with a socket. By pressing a key down, the screw-worm pulls down the lever, and the latter the tracker. This contrivance is sometimes made, in order to give the keys a lesser fall. In *Table V*, *fig.* 1, *a* is the tracker, *b* and *c* are adjusting screws, *d* is the lever or blind key, *e* the real key. In back-choirs, the mechanism of the key-boards is again different. If the back-choir belongs to the lower manual, the mechanism is generally thus:—Below the key there is a pricker, with an adjusting-screw on its lower end; this screw stands in an arm of the roller, the other arm of which is again connected with a second pricker. The lower end of this pricker sits upon the horizontal shank of an angle-hook, whilst the vertical shank of this hook receives a tracker, which lies below the floor, and is connected with the corresponding palate. The palates, in back-choirs, are not placed in a horizontal, but in a vertical position. If the manual of the back-choir lies above the manual of the great organ, then the back-end of the key (*Table V*, *fig.* 3, *a*) pulls up a tracker (*c*), and by this means the horizontal shank of an angle-hook (*C*). The vertical shank of this hook raises the tracker (*e*), which lies beneath the floor, and is connected with the palate (*f*). This tracker is kept in its position by a holder (*g*). If the manual is on the back-choir itself, then the mechanism is the same, though with this difference, that the horizontal shank of the angle-hook is not turned towards the interior, but towards the exterior of the back-choir. Should, in such a mechanism, the wind-chest of the back-choir lay considerably lower or deeper than the floor, then the lower vertical shank of the angle-hook could not directly be connected with the tracker, which opens the palate; but there is a short tracker proceeding from that shank and going to the upper end of a horizontal lever, which lies with its lower end in a sheath. In the middle of this lever is a second tracker, which is directly connected with the palate.

The action of the pedale differs more or less from that of the manual. The pedale, like the manual, is enclosed in a frame of oak. The pedal-keys, however, do not move in pegs on their back end, like the manual-keys, but on their front end. These pegs are not visible, because they are covered by a ledge, which is screwed upon the frame. The cuts of the frame, in which the pedal-keys move up and down, are lined with leather or felt, to prevent their rattling. Directly behind the pedale, in the interior of the organ (see *Table V, fig.* 4, *A*), there is a shank (*a*), which contains as many angle-hooks as there are keys on the pedale. The lower, horizontal arm of the angle-hooks (*b*) lies just below the continuation of the key (*c*). The upper shank (*d*) holds a tracker (*e*), which runs along, parallel with the floor, and joins with its opposite end the vertical shank of a second angle-hook (*f*), the horizontal shank of which receives the wire-sling of another tracker (*g*). This tracker runs upwards, along the roller-board of the pedale, and joins one arm of a roller, the second arm of which is provided with a tracker, which is connected with the corresponding palate in the usual way. In some organs the keys do not directly touch the horizontal arm of the angle-hook; but there are prickers below all the keys, which are on their lower end provided with wire-tacks. These tacks go through the hole of the horizontal shank of the angle-hook. The rest of the mechanism is the same as above.

If in large organs the several pedal-registers cannot stand upon one wind-chest, but have two wind-chests, one for the reed-registers, the other for the flue-registers, then the lower shank of that angle-hook, the sheath of which stands below the roller-board of the first wind-chest, is provided with a tracker, which runs on below that same wind-chest, and joins the lower shank of an angle-hook, the sheath of which lies below the roller-board of the second wind-chest. The upper, horizontal shank of this latter angle-hook is, by a tracker, connected with the one arm of a roller, the second arm of which is, in the same way, connected with the palate. In some organs there are, below the pedal-keys, springs of iron or brass wire. This is done to divide the pressure more equally between these springs and the palate-springs, and to spare the strength of the latter.

CHAPTER IV.

THE COPULAS.

The copula is that contrivance by which two or more key-boards are so connected, that if the one is played upon, the other acts at the same time. In some few instances, the keys of that manual which is coupled to another do not move, but stand still, though their respective pipes sound; such a contrivance is said to be on some organ in Copenhagen; and the translator, too, recollects having seen it on an organ in Germany. This contrivance is of importance, because, by this means, one person can play several manuals at once, and thus display the entire power of the organ. Suppose an organ has two manuals, one with twelve, the other with eight registers. If the copula is not used, and the organist plays upon the former manual, of course only twelve registers will be heard, whilst, if the copula is drawn, twenty registers will sound at once. A copula which connects two manuals with each other is called a *manual-copula.*

There are various kinds of manual-copulas. The first is represented by *fig.* 7 on *Table V.* Its mechanism is as follows:—The screw-worm (*a*), which rests upon every key of the lower manual, and which is connected with the corresponding tracker (*d*) by a socket (*c*), goes through an oblong cut, contained in the corresponding key of the upper manual (*e*). Upon the key of this latter manual lies a small block of wood (*f*), cut out in form of a fork. The screw-worm is, below the socket of the tracker (*d*), provided with a second socket (*g*), by which the whole copula is managed, which is hence called the copula-socket. Now, in case the ends of the above-mentioned little block (*f*) should be turned towards the outside of the organ, then it would be necessary, in order to effect the coupling, to draw out simultaneously the two buttons of wood, or metal, which are on each side of the upper manual; whilst, if these ends of the block were turned to the inside of the organ, the buttons would have to be pushed in. In this way the whole upper manual is moved from its place, so that all the blocks (*f*) upon the keys of the lower manual come to stand exactly below the above-mentioned copula-sockets. Thus, by pressing down a key of the lower manual, the copula-socket (*g*) places itself instantly upon the block (*f*), pulling down thereby the corresponding upper manual.

In undoing the copula, the keys of the upper manual, with their blocks, move away from below the copula-sockets, and the latter pass the blocks without touching them, whereby the coupling is undone. Sometimes this kind of copula has the mechanism as shewn by *fig.* 11, *a*. Here the keys of the upper manual have small blocks of wood below (*b*), which are on their front cut out in form of forks. In coupling, these forks move on, so as to stand below the adjusting screws or sockets (*d*), which are upon the keys of the lower manual, whereby both the forks and the keys of the upper manual are pulled down as soon as the lower manual is played upon. It must be observed that, when the copula has the mechanism above-described, the hand must not be kept upon the lower manual during the act of coupling, or else the forks, instead of moving on below the copula-sockets, will come to stand above them, in consequence of which some of the screw-worms might get bent, or some pipes begin to howl, or something else in some part of the mechanism be spoiled. This remark is the more necessary, as, in some organs, the coupling is effected, not by drawing out the buttons, but merely by drawing one sort of stop. Here the organist might be tempted to play with one hand upon the lower manual, whilst drawing the copula with the other.

The second kind of manual copula is represented by *fig.* 6, on the same Table. Between the keys of the two manuals there is a sheath (*a*), with as many levers as the manuals have keys. In the middle of each lever is a screw-worm (*b*), which goes through an oblong cut in the key of the upper manual (*c*), and is provided with a socket (*d*). In the key of the lower manual (*e*) there is likewise a screw-worm (*f*), which goes loosely through the front end of the lever, and has also a socket (*g*). In coupling, the copula-socket of the lower manual pulls down the lever, whilst the socket of the lever pulls down the corresponding key of the upper manual. In undoing the copula, the levers fall on their front so deep that the socket of the lower manual can hardly pull them down any deeper, whilst on their back, these levers, together with their sheaths, rise so near to the keys of the upper manual, as to make it impossible for the latter to be pulled down by the lever-screw (*d*). There are several sub-divisions of this sort of copula. Sometimes the contrivance is such, that the upper manual, when played upon, presses down at the same time the keys of the lower manual, instead of the upper manual being pulled down by the lower.

A third kind of copula, both ingenious and well adapted to the purpose, is represented by *fig.* 9. It was made use of by the organ-builder Hortig in the organ for St. Bernhardin, Breslau. Here is, below the keys of the upper manual (*a*), in the interior of the organ, a sheath (*b*), with as many joint-levers as the manual has keys. As soon as the copula is drawn, the back part (*d*) of each lever places itself upon the corresponding key of the lower manual (*e*). The lower manual is one of the sort described in the preceding chapter, with its keys rising on their back ends. Now, in pressing a key of the lower manual down, that key rises on its back, and raises thereby the corresponding joint-lever, whilst the front of this lever simultaneously presses down the corresponding key of the upper manual. In this way the two manuals do not at all move from their places. In undoing the copula, the sheath of the levers, which is fastened to a strong horizontal roller (*f*) by means of two arms (*h*), moves away from the keys of the lower manual, so that the latter can no longer touch the levers. In such an organ the coupling may be effected while the playing is continued. On the arm (*g*) hangs the stop. At *i* is a moveable piece of wood, which, by means of the adjusting-screw (*k*), can be put higher or lower. *L* are the trackers for the lower, *m* those for the upper manual. The hand-draw stop which is bent here, is not necessarily so, but may be straight whenever there is sufficient space.

The fourth kind of copulas we see represented by *fig.* 5. Here *a* is a small block glued upon the key of the lower manual. In this block is an angle-hook, the lower shank of which goes loosely into a screw-worm (*c*). The latter goes through a cut in the corresponding key of the upper manual, and is here, on its upper end, provided with a socket (*d*) or nut. Below the keys of the upper manual is a sheath (*e*), from which a lever (*f*) proceeds on to the end of the upper shank (*d*), as soon as, in the act of coupling, that sheath moves forwards; this motion of the lever causes the screw-worm (in *c*) to stand so low, that the adjusting-screw (*d*) lays itself upon the key of the upper manual, and presses the latter down as soon as the corresponding key of the lower manual is played upon. In undoing the copula, the sheath turns farther back towards *e*, whereby the adjusting-screw comes to stand above the key of the lower manual.

A fifth sort of copulas is shown by *fig.* 8. The keys of the upper manual have below, and the keys of the lower manual have above, little square blocks of wood (*a*, *b*), which place themselves vertically above or below each other, as soon as one of the manuals is pushed backwards or forwards by means of the copula. Here the upper manual must be played upon, if the lower one is to act too. In undoing the copula the blocks pass each other without coming in contact.

In organs with three manuals the mechanism of the copulas is the same as described here, though with more or less deviations. But there is a great difference as to the mode in which the three manuals are combined together. In some organs the middle manual (which is generally the great organ) is fixed; the upper manual must be drawn out, and the lower one be pushed in, if they are to act all three together. Sometimes the lower manual stands fixed, whilst the two others are moveable. For the same reason the two manuals which are coupled, are sometimes managed by the lower. sometimes by the middle manual; that is, sometimes the lower manual is played upon, and then the two upper ones are pulled down. Sometimes the middle manual is played upon, and then the lower one is raised up and the upper one pulled down. In the first case, the second sort of copula is generally used (see *fig.* 12), in the second case, the fifth sort (see *fig.* 13).

The pedal-copula is a contrivance by which, in order to give the pedal tones more distinctness and decision, the two lowest octaves of the manual may be joined or coupled to the pedale, so that, for instance, when pressing the key G of the pedale down, not only the G's of all the various pedal-registers are heard, but also the G's of all the manual-registers which may have been drawn. As many tones or keys as the pedale has, so many tones of the manual may be coupled to it. In organs with two or more manuals, the great-organ is commonly combined with the pedale by a copula, because it contains the strongest and most numerous registers. The mechanism of pedal-copulas varies very much. In some organs there is behind the front-ledge of the pedale, a roller-board, by the rollers of which, together with their trackers, the manual-keys are coupled to the pedal-keys. Thus, for instance, by treading the pedal-key f down, the same f sinks down in the manual also. This contrivance is indeed cheap, but bad, and still more so when there is no contrivance for undoing the copula again, as is frequently the case in old organs. To a player who is not acquainted with such a contrivance it must be very vexing, if he sees the keys in the manual, which he intends to press down with his left hand, already pulled down by the pedal. Where such a contrivance exists, an additional stop should be placed at the disposal of the player, by means of which he would be able to undo the copula again.

Another mechanism, better than the one described, though more complicated and expensive, we meet with in those organs which have two palates for the two lowest octaves of the principal manual. Of these two palates, the one belongs to a manual key, the other to the corresponding pedal-key. Every palate is first connected with one of the trackers by a purse-wire, in the mode described in former chapters. Above the trackers, which are connected with the pedal-palates, there is a roller-board with its rollers. In the other arm of that roller hangs another tracker (see *fig.* 10), which by means of an adjusting-screw (*h*), is connected with the horizontal shank of an angle-hook (*a*), the sheath of which (*d*) lies above the trackers for the pedal-palates (*b*). Where there are partitioned wind-chests, the connection is effected by particular roller-boards, roller-frames, &c. The shanks of the angle-hook are turned downwards, and cut out in form of a fork, so that when the pedal-copula is not used, the pedal-trackers (*b*) can easily go through them. Behind the shanks are, on the pedal-trackers, small blocks of wood (c). By drawing out the copula, the sheath (*d*) moves with its angle-hook towards the blocks, so that the latter and the shanks of the angle-hook touch each other. In treading a pedal-key down, it first presses upon the horizontal shank of the angle-hook, which lies below that pedal-key. The pedal-tracker (*b*), which is fastened to the vertical shank of that angle-hook, now moves forward; the blocks on the pedal-trackers, through that shank of the angle-hook by which the coupling is effected, likewise moves forward, whilst the other shank pulls down the tracker (*f*), which is connected with one arm of a roller, the second arm of which opens the corresponding palate. In uncoupling again, the angle-hooks move so far away from the blocks, that the former cannot be touched by the latter, and consequently cannot be moved either. *G* is the tracker which belongs to the wind-chest of the pedale.

Another kind of pedal-copula has the following mechanism. The rollers are not connected with separate copula-palates, but they join directly the manual-trackers and their palates, these trackers being pulled down by the pedal-keys as well as by the manual-keys. To prevent the simultaneous sinking of the manual-keys, when their trackers are pulled down by the pedal-keys, there is below the manual a sort of second manual (as described in the foregoing chapter), which rests on springs, and is provided with adjusting screws, by which the falling or sinking of the manual-keys is prevented. This sort of copula might be used in cases where the room is rather limited; the only inconvenience is this, that on such organs the action of the keys in the two lowest octaves on the manual is rather hard, on account of the springs below them. But the author has seen some mechanism, which for the present must remain a secret, by which even this inconvenience is avoided.

One sort of copula we have yet to mention, by the application of which it becomes possible that two manuals may act upon one wind-chest, or that the pedale may act upon one, two, or three wind-chests. This mechanism allows a much greater variety in the combinations of registers, and renders it possible to use, of the manual registers, only the larger ones for the pedale, no matter whether they are drawn out in the manual or not. If the pedale is to borrow its pipes from the wind-chest of the manual, provided the combination of registers is undetermined, then the manual must have a partitioned wind-chest, namely one half for the treble, the other half for the bass, from C to $\overline{c}$ or $\overline{d}$. The partition for the bass row contains, instead of 25, 26, or 27 grooves, 50, 52, or 54 of them, two of which together are always intended for one and the same tone, and closely adjoin each other. One of these grooves, for instance, is for C in the pedale, the other for the same C in the manual;—so for C sharp, D, &c. In each of these grooves there is, as usual, for every pipe a separate wind-conductor, through which the wind passes to the upper-board. But these wind-conductors in the wind-chest do not run along in a straight line, but they stand, in the corresponding grooves, so much in advance of each other, as is rendered necessary by the slides; for example, thus:—

o o o o
o o o o

From this we see that the wind-conductors, both for the manual as well as for the pedale, run along by themselves in a straight line, whilst the two which belong to one pipe have different positions. Where such a mechanism exists, the upper-boards of registers with two ranks, and of all mixtures in general, consist of two parts, lying above each other, one of which is roughly covered with leather, to render it more hermetical. In the lower part is a simple wind-chest or conveyance, which leads to a hollow in the upper-board. These conductors are long enough to pass the corresponding grooves. Above the two conductors there are counter-palates, faced with leather, each of which by means of its tail, is closely glued to the conductor. Each of these counter-palates must be planed off, and must be large enough to cover, with its rough side, the entire conductors. In the upper half of the upper-board there is but one conductor, just below the corresponding pipes; but in a mixture-register, that half has as many conductors as there are pipes to one key, as is generally the case with mixtures. The trackers have the same position as in other organs, only that those two of them which belong together to one key, are not separated by ledges. Every register has a complete action of its own; the inscriptions on the stops merely say whether the register belongs to the manual or to the pedale; for instance, octave 4-feet pedale or octave 4-feet manual. Now by drawing, for example, the diapason of the manual, leaving the diapason of the pedale undrawn, and by pressing down C in the manual, the palate in the C wind-chest of the manual opens, the wind passes through the conductor, which lies above the C groove of the manual, into the hollow which contains the conductors, presses here the counter-palate upon the C groove of the pedal conductor, and passes finally to the pipes, by lifting up the counter-palate in the C groove of the manual. If the counter-palate were not to lie above the conductor of the pedal-groove, a correct intonation would be impossible. By pushing the manual diapason in, and pulling the pedal diapason out, the same is done with respect to the other counter-palate. Finally, we must observe, that the triangles in the *figs.* 1, 3, 5 to 9, and 11 to 13, upon *Table V*, denote the points whereon the corresponding keys rest.

PART IV.

THE PIPES.

CHAPTER I.

ON PIPES IN GENERAL.

The pipes, for the most part, are in the interior of the organ, and only a small number of them are visible from without. They are composed of wood, pewter, or what is called pipe-metal; the latter is nothing but a composition of tin and lead. In former times pipes were made of gold, silver, brass, copper, alabaster, glass, clay, and even of paper. The two first of these materials are too costly, and the two latter have not been found to succeed, wherefore the three materials mentioned above are now exclusively used. Of wood, the oak, pear-tree, and maple are the best, though fir and pine are used too. Of the metals, English pewter is the best and most durable material. To render this pewter fit for the use of the organ-builder, it is first melted and poured into a square bench, so that the cast assumes the form of a plate. The bottom of that bench is lined with linen, which is first varnished with glue and bole. The pewter plate, when quite dry, is taken out, and the cast, if necessary, is repeated. The plates are then prepared, planed off, and, according to circumstances, hammered. By being hammered, the pewter becomes compact and hard, and the pipes which are composed of it produce a very clear and bright tone. After having thus been prepared, the breadth and whole measure of the pipe which is to be cast is marked on the pewter plate, and the requisite piece is cut out. This piece is then rounded, formed, and provided with lips, upon a piece of wood which has the form of a cylinder or of a cone. The two adjoining edges of the plate are then varnished with bole and soldered together. The lower part of the pipe (the foot) is prepared in the same way, the lip is soldered on, and, finally, the body of the pipe is joined to the foot, likewise by means of soldering. The wooden pipes are generally square columns or pyramids. The boards used for them are carefully planed off and glued together, so as to form a longer or shorter canal. In large pipes the boards are, besides this, kept together by wooden pegs, which have been dipped in glue. The inside of the boards is varnished with glue and bole, to render the wood smoother and more compact, whereby the tone is improved, and the damage by worms in some measure prevented. The knots and knags in the wood are glued over with leather, to prevent their falling out. The lower part of the pipes rests on a square block of wood, which has a hole to admit the wind. As for the rest, the various parts of the pipes are hereafter described.

CHAPTER II.

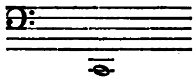
MEASURE AND SIZE OF THE PIPES.

As the organ exceeds in compass all other musical instruments, the pipes must of course be of various size and width. With stringed instruments the lower tone requires a long and thick, the higher tone, a short and thin string. In like manner, the lower tones of the organ require a long and wide, the higher ones, a short and narrow pipe. The width of a pipe is called its *measure*;[*] thus, we say, this pipe has a wide, that one a narrower measure. The measure of a pipe depends, in some degree, on its length, but also on the character of the tone which it is to produce. There are pipes of equal length, and yet of a different measure. A pipe which is to produce a full, round tone, requires a wide measure, whilst a pipe with a soft and cutting or penetrating tone must have a narrow measure. The *length* of the pipes likewise varies very much. The greatest length is 32 feet; the least, one inch. In this we only include the *body* of the pipe, as the foot has nothing to do with the production of sound. Since, in every organ, the deepest tone, in the manual as well as in the pedale, is C (there are some organs, especially in England, where the pedale begins with G), and since the size of all the pipes belonging to one register is determined by the length of the lowest C, the following C's may be considered as the normal or standard pipes of an organ:—

---

[*] Or *scale*.

1.—A C which is *thirty-two feet long* produces a tone which cannot be produced, either by any other musical instrument, or by the human voice, for it stands two octaves below the great C of a pianoforte, this C being written thus:— or an octave below the lowest note of the very largest sort of pianoforte (the grand).



2.—A C, *sixteen feet long*, produces a tone which is an octave higher than that of the preceding pipe, and of the same depth as the lowest note of a grand piano containing 6½ octaves.

3.—A C, *eight feet long*, produces a tone which can be produced by all kinds of bass instruments, by the piano, and by the human voice in some few cases. It is the same C which, when occurring in pianoforte music, stands on the second ledger line below the stave, in the bass clef.

4. A C, *four feet long*, is the same as the lowest tone of a tenor-violin, or as the c on the piano, standing in the second space of the bass clef.

5.—A C, *two feet long*, produces $\overline{c}$

6.—A C, *one foot long*, produces $\overline{\overline{c}}$.

7.—A C, *half a foot long*, produces $\overline{\overline{\overline{c}}}$.

8.—A C, *a quarter of a foot long*, produces $\overline{\overline{\overline{\overline{c}}}}$.

9.—A C, *an eighth of a foot long*, produces $\overline{\overline{\overline{\overline{\overline{c}}}}}$. This c, as well as the former, cannot be reached by the human voice. The last c cannot be produced by any other musical instrument either.

The size of all the other pipes belonging, together with one of these C's, to the same register, depends on that C, so that, for the higher tones, the pipes become gradually shorter and narrower.

CHAPTER III.

THE VARIOUS KINDS OF PIPES, AND THEIR STRUCTURE.

The tone of the organ is at one time full and round, at another, thin and cutting, or braying and shrill, or fluting and whispering. The organ thus represents an orchestra. This vast difference in the character of tone arises from a corresponding difference in the structure of the pipes, according to which, all pipes are brought into two principal classes :—1. *flue*, or *labial pipes ;* 2. *reed pipes.*

I.—The flue or labial pipes. The word labial is derived from the Latin word *labium* ("lip"), because each of these pipes has two lips, an upper and an under lip. The parts of a labial pipe of pewter or brass are :—1. The *foot* upon which the whole pipe rests ; it has the form of an inverted cone (*Table* 6, *fig.* 1.—2. The *language* (*fig.* 2, the same as *a* in *fig.* 1), just above the foot to which it is soldered on. It is almost round, with the exception of a small segment, which is cut out.—3. The *under lip* (*fig.* 1, *b*), on the foot, and immediately below the language, which it very nearly joins at *c* and *d*. This lip is in fact not a separate part of the pipe, but merely an incavation on the foot, having at its lower end the form of a tongue, as we see on *fig.* 1.—4. The *wedge* of the mouth (the under and upper lip form the mouth) is the interval between the under lip and the language, and is represented in *fig* 1 by the black line *c d*. Through this space the wind passes into the pipe.—5. The body of the pipes is soldered upon the foot (*fig.* 3, *a*).—6. The upper lip (*fig.* 3, *b*) on the lower part of the body, forming, together with the under lip, the mouth of the pipe.—7. The height (*fig.* 3, *c*) is the square opening between the two lips.

The length and breadth of the lips must bear a proper proportion to the size and measure of the pipes. There are two sorts of lips, plain and elevated ones, the latter, as we see them in *fig.* 4, are sometimes given to front pipes as a sort of ornament. The height* must be duly proportioned too, a pipe of a cutting intonation requires a smaller height, whilst a pipe with a strong round tone, must have a greater height. If the height is too small the pipe will over-blow itself, that is it will sound an octave higher, if the height is too great the intonation will be dull and faint. In sounding a pipe, the following are the functions conferred to the various parts of it. The foot of the pipe receives the wind, which forthwith passes through the wedge of the mouth. Here the wind is by the upper lip divided as it were into two halves. One half of the wind quits the pipe again through the height, the other half causes a vibration of the air contained in the body of the pipe, and is thus the immediate cause of the tone. The good intonation, or speaking of a pipe, depends on the correct position of the lips. If the upper lip were pressed too much inwards, it would prevent the wind from coming properly in contact with the air in the pipe, and vibration would thus become impossible or difficult. On the contrary, if the upper lip were bent too much outwards, the wind would simply pass out of the pipe through the height, without causing any vibration at all. In both cases a mere humming or whizzing would be heard.

---

* Called by English organ-builders "the mouth."

With some labial pipes, which have a particularly heavy intonation, it becomes necessary to keep the wind together, and thereby facilitate the intonation. For this purpose, some organ-builders provide the height on both sides with what they call a *beard*. The *figs*. 5, 6, 7 and 8 show us several kinds of them.

The parts of a wooden flue-pipe are the same, only of a more or less altered shape. *Fig*. 12 represents the language of a large wood pipe, *fig*. 13 that of a small one. In both figures *a* is the plain (level) of the language, *b* the plain opposite the under lip. The under lip, the lower side of the language, the bottom of the pipe, and the three boards of the pipe, enclose together an empty space, which may be considered as the wind-box of the pipe, as we see in *fig*. 14, where the under-lip is omitted, so that this space may be better distinguished. At *fig*. 9 the wind-box is concealed, because here the under lip is screwed on by three screws. The line going across the letter C is the language, the dark space *d* is the height, *b* the upper lip, which is here simply formed by the planing off, in an oblique direction, of the board which helps to form the body of the pipe. Beards* are used for wooden flue-pipes, as well as for pewter or brass ones. The *figs.* 15, 10 *a*, 11 and 16 represent wooden flue-pipes with beards. The tone of flue-pipes is sometimes flute-like, and sometimes violin-like, or cutting, a difference which arises from a difference both in their measure and in their structure. Regarding merely their structure, and setting aside their measure, the flue-pipes are divided into open, and stopped or covered flue-pipes.

---

* "Lips" is the term used by English organ-builders.

1. Open flue-pipes. We call a pipe open, if its upper end or aperture is not shut up, so that the air which is in the pipe when vibrating, cannot act upon the outward air. The form of open flue-pipes is:—1. Either that of a cylinder or of a prism, that is, equally wide both ends (*Table VII, figs.* 1, 2 and 9). All diapasons and principals with their sub-divisions, and likewise some other registers, have this form:—2. Or that of a cone or pyramid, that is, they are either narrower above than below, like the gemshorn, the gamba, &c., see *figs.* 5, 6 and 10; or wider above than below, like the dolcan, *figs.* 4 and 11, or the salicet, *figs.* 3, &c. 3. Or they are cylinders and cones at the same time, as is the case with the flach flute, *fig.* 7, and spill flute, *fig.* 8.

2. Stopped flue-pipes. We call a pipe stopped, the aperture of which is shut up. In such pipes the process in the production of the tone is different from that of open flue-pipes. Here the column of air in the pipe, when vibrating, acts upon the outward air through the height of the pipe only, but not through its aperture. The consequence is that of two flue-pipes of equal length, one of which is open and the other stopped, the stopped one will produce a tone which is an octave lower than that produced by the open pipe. Thus, a stopped flue-pipe of a given length, and an open flue-pipe of twice that length, will produce the same tone. The stopping of pipes is a very important invention, for it not only saves great expense, but it also increases the variety of tone which an organ is capable of producing. Stopped pipes have always a softer and more subdued tone than open pipes; the stopping is effected by a sort of capsule, similar to the lid of a round brass box, called the *stopper* (*Table VIII, figs.* 6 and 7). Brass pipes have stoppers of brass, wood pipes stoppers of wood. In both cases the edges and the lower side of the stoppers are covered with white leather, so as to fit accurately the apertures of the pipes. In small and middle-

sized pipes, the stoppers have a sort of handle, by which they may be easily drawn out. The largest pipes have, for this purpose, some other contrivance, which will be hereafter described. There is one register, the pipes of which are but half-stopped, the rohr flute or reed flute, perhaps the same as that which the English call the metal stop-diapason. Here, indeed, the pipes have stoppers, but the stoppers have hollow tubes going through them, so that there is at least some communication between the air in the pipe and that out of it. The tone of these pipes is weaker than that of open pipes, though brighter than that of pipes which are completely stopped.

II.—The reed-pipes. Their structure is very different from that of flue-pipes, whence their different character of tone. The tone of reed-pipes is more rattling, sharp, and of a peculiar brilliancy. Thus we may say the flue-pipes, with their mysterious, dignified and solemn tone, form the basis of an organ, whilst the reed-pipes, with their bright, cheering and brilliant tone, are the ornaments. The difference in the structure of these pipes will be evident when we describe their various parts, the more so, when we say that in reed-pipes the body of the pipe has nothing to do with the production of tone, but that it is produced by an artificial contrivance called the mouth-piece. The body of the pipe is merely intended to ripen the tone, as it were, or to finish it off. Of this we can easily convince ourselves, if we take, for instance, a clarionet, the tone of which is imitated by the reed-pipes of that register, which, for this reason, is called the clarionet. If we take from a clarionet its mouth-piece, or reed, and blow into the remaining body of the instrument, there will be no tone, but merely a feeble noise produced. The same would be the result, if we were to remove from a reed-pipe its mouth-piece. Now, if we blow into the mouth-piece by itself, without its being joined to the body, a tone indeed will be produced, but always the same, and a very disagreeable, squeaking one too. Thus, the mouth-piece produces the tone, but the body of the pipe forms and modifies it, both in pitch and in character. The parts of a reed-pipe are—1. The body of the pipe. Its form depends on the material of which it is composed. Reed-pipes of pewter or brass have the form of inverted cones (*Table IX, figs.* 1, 6, 13), those of wood the form of inverted pyramids (*figs.* 5, 10, 17). Sometimes, reed-pipes have also the form of cylinders, and stand upon feet like labial-pipes. Here the bodies of the pipes are mere tubes, devoid of the parts of a flue-pipe (*figs.* 7 and 9). 2. The mouth-piece. It consists of *a*, the *block*, which is of a square form, and has on its lower side several incuts. Through the middle of the block is a round hole, in which the body of the pipe rests, (see *Table IX, fig.* 4). Near this hole is a smaller one, intimated in the drawing by a dot, through which the wire is pulled. *b*, the *beak;* it forms the vertical intersection of a tube, which has more or less the form of a cylinder. The beak is either of wood, pewter, or brass (see *figs.* 2 and 3). Its edges are lined with leather, to prevent the tone from getting too rough and rattling. *c*, the *tongue*, is a strip of brass, which accurately covers the edges of the beak (*figs.* 11 and 12). There are reed-pipes where the tongue does not beat upon the outside of the edges of the beak, but on the inside; their tone is not so strong and full as that of other pipes. We say of such pipes, they have free-vibrating tongues. *d*, the *spring*, is a wire, which goes through the block and presses the tongue upon the beak. Its lower end is bent in three different directions (*fig.* 15). Sometimes, its upper end is bent in form of a hook (*figs.* 13, 21, 22). In old reed-stops the spring sometimes goes through the body of the pipe. *e*, the *reed*, is a sort of wedge of hard wood, which serves to keep the beak and tongue fast in the hole of the block (*fig.* 16). 3. The third principal part of a reed-pipe is the foot. This is a square box of wood, which stands upon the upper-board, concealing and containing all the above-mentioned parts of the mouth-piece. It also bears the body of the pipe, which stands in the hole of the block. Of the smaller pipes of a reed-register, six or more have sometimes one foot in common with each other. *Fig.* 14 shows the form of the foot. In old reed-pipes we sometimes meet with feet of pewter or brass, which have a round form, instead of a square one (*figs.* 21, 22, 23).

To see the functions of the various parts of a reed-pipe, we must look at *fig.* 13. In the lower part (*b*) of the block (*a*), is the beak (*c*), the interior of which is closely covered by the tongue (*d*). A small reed or wedge (*e*), which is as broad as the tongue, prevents the falling out of the latter, and of the beak. Before the wedge, opposite the tongue, is the hole through which the spring (*f*) goes.

The upper end of the spring (*g*) projects more or less from the block, whilst its lower end (*h*), acts as a spring upon the tongue, and presses the latter upon the beak. All these parts of the mouth-piece are not visible, but shut up by the foot (*A*), which is indicated by dotted lines. From the hole in the block projects the body of the pipe (*i*). As a matter of course, all these parts must be properly proportioned, and so constructed as to fit each other precisely. The size of the reed-pipes depends of course on the height or depth of the tone which they are to produce, and if there are reed-pipes with proportionately very short bodies, they either belong to obsolete registers, or to the class of stopped reed-registers. We have now to add something respecting the production of tone in reed-pipes. As soon as a key in the manual or pedale is pressed down, and the corresponding palate opened, the foot of the pipe is completely filled with wind. The wind in seeking an outlet, passes into the space between the tongue and beak, a space which is however too small to allow the whole mass of wind to pass through undisturbedly. Only so much of the wind can pass as is necessary to cause a vibration of the air in the body of the pipe. The rest of the wind, struggling to remove the impediment in its way, constantly strives to throw the tongue away from the beak. But in this struggle, the tongue is assisted by the spring, which presses the former hard upon the beak, and leaves the wind but little scope. The tongue being in this way continually thrown upon the beak by the spring, and thrown back again by the wind, is put in constant vibration. This vibration is imparted to that portion of the wind which passes into the body of the pipe, and here the air contained in the body is caused to vibrate likewise. Hence arises the rattling of tones, which is so peculiar to reed-pipes, though of course much more perceptible in larger pipes than in smaller ones, because the vibration is much slower in the former than in the latter. In reed-pipes, which are anything like thirty-two feet long, if the various parts are not most accurately constructed, we hear but an indistinct rattling, instead of a tone. The higher the spring stands upon the tongue, and the more distant the latter is from the beak, the slower is the vibration, and the deeper the tone, and *vice versa*. The reed-pipes imitate the tone of various wind-instruments, as likewise the human voice (vox humana).

The reed-pipes, like the flue-pipes, are either stopped or open; but they cannot be stopped completely like flue-pipes, because the wind would then have no outlet at all, as reed-pipes have no height through which the wind might pass. The stoppers of reed-pipes have an opening to let out the sound and the wind. Thus, the stopping of reed-pipes is nothing but a narrowing of their aperture. The higher the tones, the larger is the opening in the stopper, till at last the stopping ceases altogether. The organ in St. Maria Magdalen's, at Breslau, contains a vox humana eight feet, beginning with c, standing in the second space of the bass stave. The pipes have wooden bodies. This c is stopped, in the way we see it in *fig.* 17. The $\overset{\equiv}{c}$ however is quite open, as in general the scale of the pipes for the higher tones is entirely altered. Sometimes reed-pipes have, besides their strange shape, holes on their sides. Thus, the organ in St. Elizabeth's, Breslau, contains a shalm, eight feet, with bodies of brass, beginning with g, in the fourth space of the bass stave. This g has the shape of *fig.* 19. Besides the opening in the stopper, there are three holes in the body of the pipe, of which, on this figure, only two are visible. The $\overset{\equiv}{c}$ pipe of this register is quite open, and has in its body two holes opposite each other (*fig.* 20). The obsolete registers; bear's pipe, and Apple, or button-regal (*figs.* 21, 22, 23), were stopped reed-registers. Reed-pipes are stopped in order to obtain a particularly soft intonation. Some organ-builders obviate the stopping, by giving the bodies of reed-pipes the form of cylinders. Reed-pipes of a strong intonation, like the trumpet and trombone, are always open.

CHAPTER IV.

THE REGISTERS (OR STOPS).

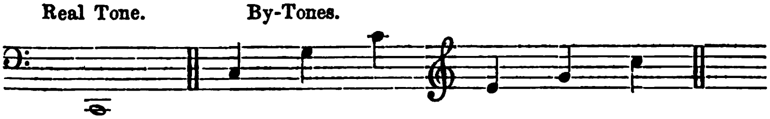
A row of pipes, which have, from the lowest to the highest, the same structure and the same character of tone, is called a *register*. The pipes forming a register stand together lengthwise upon the wind-chest. The pipes standing upon conductors are, so far, an exception to this, that they sometimes stand on the sides of the organ-case. Circumstances sometimes induce the organ-builder to arrange the pipes of a register in this way,—

o o o o o

o o o o o

especially, if there is not room enough, to give the wind-chest its proper size. The size of a register is determined by the size of its lowest C. Thus, if the lowest C of a register is eight feet long, then the whole register is called an *eight feet register*, and so on. As stopped pipes of a given length produce a tone which is an octave lower than the tone produced by flue-pipes of the same length, the lowest pipe of a stopped register measures only half the length of an open register of the same name. Thus, for instance, a stop-diapason of four feet produces the same tones as an open diapason of eight feet. In this case we say the former diapason is an *eight feet tone*, because it is in fact like a diapason of eight feet, though its lowest pipe is actually but four feet long. Some registers do not run through the whole manual, but only through the highest or lowest octaves, because their intonation would be imperfect in the other octaves. This is particularly the case with those registers which imitate wind-instruments, for instance, the hautboy, clarionet, bassoon, &c. But sometimes, even such registers are incomplete, which might, with all propriety, be carried through the whole manual; this is bad economy, and wretched bungling. We distinguish between *principal registers*, *secondary registers*, and *mixtures*. Of the former we reckon all those registers, the pipes of which always sound that tone which bears the same name as the key, which must be pressed down in order to produce that tone; for instance, if the f key is pressed down, the tone f sounds. All the registers with an even number of feet belong to this class, such as diapasons, principals, and octaves. The most important, and, at the same time, appropriate registers are, for the manual, the eight feet; for the pedale, the sixteen feet. The eight feet correspond exactly with the human voice; that is, if an eight feet is drawn, and a note played, that note is exactly of the same pitch as if it were sung by a man or woman. Secondary, or filling-out registers, are those which do not sound the tone the corresponding key of which is pressed down, but another, either a third or a fifth higher; for instance, the key g sounds b, the key d sounds a, and so on. In this class are included all thirds and fifths. In some old organs the third is called the sixth, but erroneously, because it is nothing but a third raised an octave; it would remain a third, however many octaves it might be raised, because we always reckon the intervals from the fundamental tone. So, if we take c as the fundamental tone, every e is the third of that c, however many octaves it may stand above it. The error in this nomenclature arose from the fact of the whole triad, c, e, g, being considered the basis, according to which intervals must be measured, instead of the tonic alone. Thus, if the e were raised an octave, it came to stand above the g, and formed to this latter tone a sixth; hence the name sixth, instead of third. The size of fifths may be 10⅔ (12), 5⅓ (6), 2⅔ (3), or 1⅓ (1½) feet. We have always given two different numbers for one register; the first number is the correct one, but the second is the one adopted by organ-builders for brevity's sake. They do not say a 10⅔ feet fifth, but a 12 feet fifth. Fifths and thirds can never be used by themselves, but only in combination with all the other registers, that is, in the full organ. They are merely intended to fill out and to soften somewhat the shrillness of the mixtures. The size of these secondary registers depends entirely on that of the principal registers. If the diapason is 32 feet long, the fifth must be 10⅔ feet, and so on. The *mixtures* are registers which have several pipes for one key. These pipes sound generally the tonic, the great or major third, the perfect fifth, and the octave, that is, a complete triad. There are several registers which come under this head, for instance, the cornetto, the cymbal, the rausk-fifth, the sharp, the sesqui-altera, and a register which is, in a more limited sense, called the mixture, hereafter described in the list of registers. As to the mutual relation between the mixture and the sesqui-altera, the English invert the thing, and say, the mixture is a kind of sesqui-altera, whereas, in fact, the sesqui-altera is a kind of mixture, as implied by the very words. Mixture is a more general name, applicable to the whole species of registers, the pipes of which do not produce one tone, but a mixture of tones, whilst sesqui-altera, as we shall see in the list of registers, is quite a special term. As to mixtures, their label does not state the size of their lowest pipes, as is the case with other registers, but it states how many pipes every key has. This is expressed by using the word *rank;* for instance, Sharp four ranks means, that in this register every key has four pipes, each of which produces a different tone. Mixtures, like secondary registers, cannot be used by themselves, but only in the full organ.

Now the question presents itself, what may have induced to the construction of registers, which, in combination with the principal registers, produce numberless false harmonical progressions, and mix up with each other tones which have nothing in common, forming but a horrible dissonance? Draw, for instance, an open eight feet register, and strike the C major chord (c, e, g). Now, if you draw also a fifth $2\frac{2}{3}$ feet, the G major chord will sound at the same time; add to it a third $1\frac{3}{5}$ foot, and the E major chord will be added to the two former chords. Thus, you have the tones C, e, g, g, b, d, e, g sharp, and b, all at the same time. Draw, instead of the third, some mixture registers, and the combination of tone will become still more outrageous. To the construction of these secondary and mixture registers, nothing can have given the impulse but the so-called by-tones, that is, the tones which are softly heard after, and at the same time, when some deep bass string or pipe is sounded; for instance, if, at night, when all is quiet, we sound the deepest string of a double bass (C), or the deepest C of a 16 or 32 feet pipe, we distinctly hear, besides the tone which we want to produce, the following by-tones,—



besides some few higher ones, which, are, however, of no consequence here. The higher the fundamental tone is, the quicker the by-tones follow each other, and the less perceptible are they. In order, therefore, to convince ourselves of the truth of the above, we must make our experiment with some very thick string or very large pipe, because their vibrations are slower, and the by-tones do not follow each other so rapidly. Although the tones of the secondary and of the mixture registers are not so soft as these natural by-tones, but quite as loud as the tones of any other register, yet they blend with each other in so wonderful a manner, that, if they are properly covered by principal registers, they do not in the least offend the ear. Mixtures, and secondary registers, though rejected by some theorists, are thus indispensible, because they cannot be replaced by any other sort of registers. They give to the large registers roundness and distinctness, which is particularly necessary for the execution of quick passages, and render the whole mass of tone distinct, sharp, articulate, full and round.

Since the mixture-registers have generally very small pipes (so small, that it would not be possible to carry them through all the octaves, as at length they would become too short), the pipes of these registers very often begin again in some higher octave with the same size, which they have one or two octaves below. This is called a repetition of that register. Sometimes the largest pipe of a mixture-register is but one foot long, and in this case the size of the pipes is the same in all the octaves. This is a bad arrangement, because it causes a constant interruption in the succession of tones, and a great disproportion between the fundamental and the additional tones. Such a mixture is hardly supportable to the ear; it drowns the bass tones by the noise of its numerous small pipes, producing an insupportable monotony throughout the whole key-board, and impairs the regular progression of harmony. The number of ranks which a mixture is to have, depends on the size of the organ, and on the number of registers. The usual number is three, four or five. A mixture with five ranks consists, for instance, of the tones c, g, c, g, c, and the size of the corresponding pipes would be 4, 2⅔, 2, 1⅓, 1 foot. Large organs have often two or three mixture-registers in one manual, and some newer organs (large ones of course) have one in the pedale too.

PART V.

ALPHABETICAL LIST OF REGISTERS,

WITH THEIR

SIZE, STRUCTURE, AND OTHER QUALITIES.

The names in this list are mostly of a German origin, Germans having been, for the most part, the inventors of the various stops. Some other names are taken from the Latin, Greek, Italian, French, or Dutch. Where there are no English words which express properly the foreign name, the translator has been of course obliged to give that name in the original language. Some registers which have never been known in England, and are now obsolete even in Germany, the translator has omitted, considering that the tendency of the present work is chiefly practical, and that it can be of no, or of very little use, to describe them. But notwithstanding this, English organists and organ-builders will see, from the following list, that the Germans possess a number of very fine registers, which are hardly known in England. The consequence is that, as English organ-builders use but such a limited number of registers, they can never obtain by them that beautiful variety which we so frequently meet with in German organs. Some few German names have already been adopted by English builders, such as hohl-flute, gemshorn, &c.

Æoline, or "reed register," in imitation of the Æolian harp. It stands in the new organ at Wismar, eight feet. The body of the pipes is very small and of a narrow measure. In other respects it is constructed like the claveoline, mentioned in the beginning of this book. It cannot be used by itself, but only in combination with some soft 8 feet stopped, or some open pipe of a narrow measure, such as the gamba, &c.

Angelica (vox), "angel's voice," is a sweet reed-register, eight feet, now obsolete. It goes only through the upper octaves, and seems to be an older kind of vox humana.

Apple, or "button regal," (see *Table IX, fig.* 23), is an obsolete reed-register, four or eight feet tone. The largest body, consisting of a tube, four inches high, has a hollow bowl on its upper end, in which are several holes, to let out the wind.

Bear's pipe (see *Table IX, figs.* 21 and 22) is an obsolete reed-register of a soft intonation, sixteen or eight feet tone. In these two figures, we see how variously the bodies of reed-pipes were stopped in former times, in order, by degrees, to obtain a better intonation.

Barem is a stopped register of a soft intonation, eight or sixteen feet tone.

Basse di viola is an open manual register, eight feet tone, very frequent in French organs. It has a wide measure, and imitates the violoncello.

Bassoon, or "fagotto," is an agreeable reed-register, eight or sixteen feet, both in the manual and pedale, of pewter, brass, or wood. This register is very differently constructed in different organs; we find it with narrow bodies, having the form of cylinders (*Table IX, fig.* 7), or wider above than below, or stopped, or with a narrower measure, or with the stopper having a hole (*fig.* 17). When constructed of wood, the holes in the stoppers become gradually larger, and at last the stopping ceases altogether. In the manual, this register is generally an eight feet, so that its tones correspond exactly with that of the bassoon. Sometimes it goes only through the two lowest octaves of the manual, leaving the upper octaves to the clarionet or hautboy. More frequently it is a sixteen feet in the pedale. Its tone being weaker than that of the trombone, it is particularly adapted for a soft, mournful performance, when it may be combined with an eight feet reed-register in the manual (the hautboy for instance) and a few eight feet flue-registers.

Bauern flute (peasant's flute) or "fistula rurestris," is a small flue-register of one, two, or four feet tone in the pedale. Sometimes the stoppers have tubes.

Bell, or "glöcklein-tone" in German, is a half-foot register of a wide measure. It stands in the swell-organ of the organ in

St. Peter's, at Görlitz. Its tone is similar to that produced by the beating of hammers upon a sonorous anvil.

Bifara, or "tibia bifaris" (pipe with a double lip), is a fine but scarce flue-register in the manual, eight or four feet, open, with diapason measure. Every pipe has, like those of the double-flute, two lips, one of which stands a little higher than the other, whereby a pleasant sort of vibration is caused, similar to that of the "unda naris" hereafter described. To obtain from this register a very soft and agreeable tone, the feet of the pipes are but partly open, so as to admit only a small portion of wind. This register is also produced in another way, viz., by giving one tone to two pipes, one of which is tuned a little higher than the other. The construction of such artificial registers is, for several reasons, not advisable. A bifara of pewter with two ranks (first rank eight feet, stopped—second rank four feet, open), of a soft, violin-like intonation, stands in the third manual of the colossal organ, built by Walker (Ludwigsburg) for St. Peter's, at Petersburg.

Block flute, "tibia vulgaris" (common flute), is a flue-register sometimes open, sometimes stopped, and now and then even with conical pipes. It is of pewter or brass, sixteen, eight, four, and two feet, and imitates the tone of a flute, into which the wind is blown from the upper end.

Bombardone or *bombardon*, is a reed-register of pewter, brass, or wood, in the manual, four, eight, and sixteen feet—in the pedale, sixteen and thirty-two feet. This register is weaker than the trombone, but stronger than the bassoon, and forms the bass of the shalm. To obtain a softer intonation, the pipes of this register are sometimes stopped as much as is possible with reed-registers. This register we mostly meet with in old organs, which contain in the pedale, at the same time, a trombone eight feet; but also in some new ones; for instance, in St. Mary's, at Wismar, where the organ has, besides, a trombone, sixteen feet, in the pedale. Sometimes this register is called dulcan or bassoon.

Clairon, French, or *clarion*, Italian (little trumpet), sometimes called bassetto, is a reed-register of a narrow measure, with a brighter tone than the common trumpet (eight feet). It belongs to the pedale, and is always a four feet. Sometimes the same pedale has both a four feet and an eight feet trumpet.

Clarabella or "dolciano," also "offen-flute" in German, is an open flue-register of fine wood, with a beautiful intonation. It stands, under the name dolciano, in the swell-organ of an organ at Görlitz, built in 1838 by Buckow. This register has of late become a favourite register of English organ-builders. It sometimes stands in the pedale, when it is called open flute-bass, and sometimes it is a sort of fifth, and called open quint-flute.

Clarionet is a reed-register, eight feet in the manual, which imitates the tone of a clarionet. The pipes are conical, like those of the trumpet, but of a narrower measure, the tone, therefore, of this register is feebler than that of the trumpet.

Compensation mixture is a mixture-register in the pedale, invented by Wilke, of New Ruppin; and first introduced, in 1838, in the organ at Salzwedel. It is intended to give the pedal-pipes an intonation as quick and decisive as possible, and to the pedale in general, such an uniform power of tone, that even quick passages, performed on the pedale, appear as round and distinct in the very lowest part as in the upper notes. According to the opinion of all competent judges, this register fully attains the end for which it was invented. Besides, this mixture does not, like other pedal mixtures, prove detrimental to the gravity of the tone. It consists of:—1. A *third*, 3⅕ feet; this rank begins with the lowest C, in the pedale, and goes up to the next G, thus consisting of eight pipes, the tone of which becomes, from D upwards, gradually weaker and weaker, so that at G it seems to disappear altogether.—2. A *fifth*, 2⅔ feet, from the lowest C to the next A, having thus ten pipes, the tone of which diminishes in the same way as with the third.—3. *Principal*, two feet, from C to G sharp, nine pipes, diminishing likewise.—4. *Fifth*, 1⅓ foot, from C to F sharp, seven pipes, diminishing upwards from C sharp, and having a wide measure, to render the tone as mellow as possible.—5. *Siff-flute*, one foot, from C to F, six pipes, measure and intonation like the fifth 1⅓ foot.

Copula, (as a register) or "coupling-flute," called thus by the old builders, because it may be coupled to, or combined with, any other register. It is a common flue-register, stopped, 4, 8, or 16 feet tone, and in some very few cases open like the hohl-flutes. It belongs to the manual and has a very agreeable tone. Some call the gemshorn a coupling-flute. The copula is sometimes also a kind of fifth, 5⅓, 2⅔, or 1⅓ feet, and in this case it is open, like the hohl-flute. Copula means also a sort of mixture, with two or three ranks; thus, there is a copula with three ranks in the pedale of the organ of St. Dominico, at Prague, consisting of fifth or quint, 2⅔ feet, fifteenth or super-octave 2 feet, and third 1⅗ feet.

Cornet, or "cornetto," is a mixture-register of a very wide measure, which begins generally at c̄ or at the g below, and goes through the upper octaves of the manual. It has a strong intonation, and a horn-like tone, which is well adapted for filling out. Sometimes, when hymns are to be sung with a melody which is not familiar to the congregation, this register will be found very efficient for the purpose of making the melody prominent, since the right hand plays the melody upon that manual which contains a cornet, whilst the left hand plays the accompaniment upon some other manual, for which weaker registers are drawn. This mixture has sometimes five ranks, 8, 4, 2⅔, 2 and 1⅗ feet, sometimes four ranks, 8, 4, 2⅔ and 1⅗ feet, sometimes three, 4, 2⅔ and 1⅗ feet. In France the lowest rank of this register is nothing but the rohr-flute, eight feet, hereafter described. Wilke deems it best to construct it with three ranks only, but so that the lowest of them is a fifth, the next an octave, and the last a third, 5⅓, 4 and 3⅕ feet, or 2⅔, 2 and 1⅗ feet. The latter arrangement is better suited for small organs, the former for large ones. The cornet is the only mixture-register which does not repeat. Cornet is also the name of an old, obsolete reed-register in the pedale, one or two feet, with a very snarling tone, and sometimes called "zinken" in German.

Cremona (*krumm-horn* in German), properly "cormorne," from *cor* "the horn," and *morne* "mournfully, still, soft," meaning a soft, quiet horn, is a reed-register of a feeble intonation, eight or four feet, of pewter or brass, open or partly stopped, and sometimes with narrow, cylindrical pipes. This register has been constructed in imitation of an old instrument, called the krumm-horn (crooked-horn), which had six holes, and was, at its lower end, bent in form of a half-circle. In the pedale this register is called cremorne-bass.

Cymbal (*cymbel*, *cimbale*) or "mixtura acuta," is a mixture-register of a measure which is a little narrower than that of the diapason, in consequence of which its tone is also sharper. It has two, three, or more ranks. The cymbal is the smallest of all mixtures, as its largest rank is but one foot. It has neither thirds nor fifths, but only octaves, 1 foot, ½ foot, and ¼ foot.

Diapason is in England the principal register of the organ. In Germany this name is unknown, there it is called principal eight feet. The pipes are composed of the best material; they have frequently elevated lips (see *Table VI, fig.* 4), and long feet. They are handsomely polished and gilded, and occupy, in various graceful figures, the front of the organ. The measure and intonation of all the other registers depend on that of the diapason. The intonation of this register is very different in different organs; sometimes full, pompous and powerful, sometimes fine, delicate and agreeable. In large organs every manual has its own diapason, each of which, together with its subordinate registers, has a different measure and intonation; for instance, in an organ with three manuals, the diapason of the great-organ has a wide measure and a strong and grave intonation; that of the choir-organ, a narrower measure, and a brilliant, sharp intonation; that of the swell-organ, a narrow measure, and a soft, delicate intonation. In an organ with two manuals, the diapason of the one manual has a wide, that of the other a narrow measure, with a corresponding difference in the tone. The diapason is always an eight feet. Sometimes the lowest octave of the diapason has wooden pipes, which are not placed in front of the organ, but somewhere in the interior of it. Sometimes, if the limited room does not allow otherwise, the pipes of the diapason are twice or thrice mitred (see subsequent page). In some organs the diapason goes only through the two upper octaves of the manual. Large organs have sometimes, in the great-organ, both a diapason eight feet and one sixteen feet, the latter being then called double-diapason, or counter-diapason. In the pedale, the diapason is generally a sixteen feet, and not unfrequently a thirty-two feet; it is then called great-diapason, or sub-diapason. When it is a thirty-two feet, the lowest pipes generally stand not in front, but in the interior of the organ; yet there are organs where even the lowest C of the thirty-two feet diapason, stands in front, and is of pewter, as is the case in several churches at Hamburgh. For a soft performance, the eight feet diapason, in the manual of a narrow measure, should not be combined with the sixteen feet diapason in the pedale, because of the full and thick tone of the latter, but rather with the gamba, or with the violon, sixteen feet. To obtain from the diapason a very strong tone, it is sometimes constructed with two ranks, both of an equal structure and size. This is the case in the organ in St. Michael's, at Hamburgh, where the diapason of the great-organ has two ranks, from G in the fourth space on the bass stave upwards through the whole manual, as likewise the diapason of the choir-organ. The great-organ of this organ contains also an octave eight feet with two ranks.

Divinare is a stopped flue-register four feet, with a beautiful (divine) tone.

Dolcan (see *Table VII, figs.* 4 and 11) is an open flue-register, four or eight feet in the manual, fine, but rarely met with. The pipes of this register are wider above than below. Sometimes the names dulcan, or block-flute are erroneously applied to it.

Dolciana, or " dolce," (in German sometimes *dulz-flute*) is a flue-register of wood or brass, eight or four feet, open, and with a narrow measure. Its tone is most lovely and beautiful. In Germany this register is now and then to be met with as a sixteen feet in the pedale, under the name of flau-tone. As an eight feet of brass, by the name dolce, this register stands in the choir-organ of the new organ in St. Peter's, at Petersburg (an instrument which we have already mentioned several times), and as a four feet of pewter in the swell-organ of the same instrument.

Doppel-flöte, (French, *flute double*) or " double-flute" is a well known flue-register, stopped, and mostly of wood. In the manual it is either an eight or four feet tone, in the pedale it is likewise an eight feet tone, and called the double-flute bass. The pipes have two lips, opposite each other (see *Table VII, fig.* 8), and two apertures in the block, which make the tone particularly bright and agreeable.

Dulcian is the same as " bassoon," the latter having originated in an old instrument called the dulcian. As an organ-register of this name we find it in the great-organ of the organ at New Ruppin, where it is a flue-register thirty-two feet, producing a fine effect.

Dulz-flute, " flauto dulcio" (sweet flute), is an open flue-register of a narrow measure, of wood, eight or four feet, with a sweet, pleasing tone. It stands sometimes also in the pedale as a sixteen feet, by the name flautone.

Echo. A simple echo consists of a single flue-register with a soft intonation, which stands behind the organ, and receives its wind through long conductors. A compound echo consists of several registers, standing behind the organ in a separate case, the inside of which is lined with felt or cloth, so that if the echo-organ is played upon, the tones seem to come from without the church; of course, the organist first plays a passage upon a stronger manual, which he then repeats on the echo-organ. The echo often contains also a mixture-register, for instance the cornet, which is then called the echo-cornet. In lieu of an echo-organ, an echo may be produced upon every organ with more than one manual, if a certain passage is first played upon the strong manual, and then upon the weaker one, with only one or two very soft registers.

Fifth, or *quinte* in German, *quinta* in Italian, is one of the secondary or filling-out registers, and is to be met with in almost every organ, both in the manual and pedale. It is open; it has cylindrical bodies and the measure of the diapasons. Yet sometimes we find it with conical bodies, when it is called *quinte-gemshorn, spitz-quinte,* or *nasat-quinte.* The size of the fifth depends on that of the diapason; if the diapason is 32 feet, the fifth is 10⅔ feet; if the D is 16 feet, the F is 5⅓ feet, and so on; D, eight feet, F, 2⅔ feet; D, or principal, 4 feet, F, 1⅓ foot. The pedal-fifth, 10⅔ feet, is called *great fifth;* the pedal-fifth, 5⅓ feet, *quint-bass.* Sometimes the fifth, 10⅔ feet, stands in the pedale, without there being a diapason 32 feet, but then there must be some other 32 feet in the pedale; in some instances, however, this fifth has no 32 feet at all with it, because, when (according to Vogler's system) combined with the 16 feet, it produces a sort of artificial 32 feet tone. The fifths, 10⅔ feet and 5⅓ feet in the pedale, and 2⅔ feet in the manual, have generally conical pipes, to soften the shrillness of the tone, and to make this register better agree with the registers of a narrower measure and of a softer intonation. A fifth which is stopped, but has a hole in the stoppers, is called *reed-fifth,* or *reed-nasat.* The pipes of fifths are of pewter or brass; that of the 10⅔ feet, sometimes of wood. The tuning of fifths is *pure*, that is, not tempered.

Fifteenth, or *decima-quinta*, or *super-octave*, is two feet, one octave higher than the octave, and two octaves higher than the diapason (eight feet).

Flach flute (shallow flute, see *Table VI, fig.* 7), is a flue-register, the pipes of which diminish in width towards their upper end, like those of the gems-horn. The pipes have broad lips, wide heights, and side-boards, in consequence of which the tone is not full, but rather thin, though not disagreeable. The size of the register varies from eight feet to one foot; the form of the pipe is either conical or cylindrical.

Flageolet, " fistula minima " (smallest pipe), is an open register of pewter or brass, either two feet or one foot. Its tone is fresh or penetrating, and imitates the tone of the instrument bearing the same name.

Flute is a general name for a number of registers, which differ, however, almost solely in their size. In Germany there are many eight feet bearing this name. In England, the register which is more especially called thus is generally a four feet. In the pedale, this register is commonly an eight feet, called *flute-bass* or *bass-flute*. Various kinds of flutes will be enumerated as follows:—

Flauta amabilis has a narrower measure than the preceding flute, and therefore a brighter tone. It is either an eight or a four feet tone.

Flautino (small flute), two feet, of pewter, stands in the third manual of the new organ in St. Peter's, at Petersburg, as likewise in several other organs, built by Buckow.

Flauto amoroso (amorous flute), four feet tone, of brass, stands in the upper manual of the organ in the church of St. Peter and Paul, at Liegnitz, in Silesia.

Flauto grave (grave flute), eight feet tone, of wood, stands in the great-organ of the organ in Sohra (Silesia), as likewise in some other organs, built by Buckow.

Flauto di Pan (Pan's flute) is a one foot pedal-register, of pewter, in the organ of the cathedral at Lund, in Sweden.

Flauto douce, or *flauto doris*, is a soft, agreeable flute-register, eight or four feet. The pipes are a little narrower above than below, and have wide heights. This register is sometimes stopped.

Fluttuan, sixteen feet, stands in the middle manual of the organ at New Ruppin, and goes from $\overline{c}$ upwards, the two lowest octaves being taken by the quinta-tön. It has a very wide measure, narrow height, strong intonation, and a horn-like tone.

Füll-flute (filling flute), four feet tone, stopped, of brass, stands in the great-organ of the organ at Triebel, in Silesia.

Fugara, "tibia aperta" (open flute), is a somewhat common flute-register, open, eight or four feet in the manual, of wood or pewter, with a narrow measure and a slow intonation. The tone is as cutting as that of the gamba, but brighter. In some few instances this register is also a sixteen feet.

Gems-horn (chamois horn) is very frequently found, and is an useful and pleasing flue-register, the pipes of which diminish in width towards their upper end (see *Table VII, figs.* 6 and 10). In the manual, this register is either an eight, four, or two feet (called hornlein, or small horn), or even one foot (super-gemshorn); in the pedale it is a sixteen feet, called gemshorn-bass. This register is also (sometimes at least) a fifth (both in the pedale and in the manual) of $10\frac{2}{3}$, $5\frac{1}{3}$, $2\frac{2}{3}$, or $1\frac{1}{3}$ feet. The pipes are generally of pewter or brass; for the sixteen feet, wood is sometimes used.

Great diapason, or *sub-diapason*, (in Germany called *unter-satz*, *major-bass* or *contra-bass*) is a stop diapason, thirty-two feet, in the pedale. In Germany this register is sometimes open.

Double, or *counter-diapason*, (in German, *sub-bass*, or *gross gedackt;* and if of a narrow measure, *bourdon-bass*) is a diapason, sixteen feet tone, in the pedale. This register is to be met with in almost every organ; in smaller organs it is generally only the sixteen feet. The tone of this register being rather feeble, it is particularly adapted for a soft, quiet performance, when it may be combined with some stopped eight feet in the pedale.

Harmonica. On this register and its construction the author could only gather that it is a register of a most refined, delicate tone, and commonly placed in the echo-organ. A harmonica stands in the echo-organ of the organ in the cathedral at Lund, in Sweden, and, as an eight feet, of wood, in the new organ in St. Peter's, at Petersburg. In both cases it is of wood, and produces a most beautiful effect.

Hautboy (see *Table IX, fig.* 7) is a fine reed-register with cylindrical or funnel-shaped pipes of a narrow measure, of pewter, brass, or wood, in which latter case the tongues of the pipes are of ivory. This register is commonly an eight feet in the manual, and imitates the tone of the instrument called the hautboy. It often goes only through the upper octaves of the manual, leaving the lower ones to the bassoon, eight feet. In consequence of the narrow measure, the tone of this register is more delicate and agreeable than that of the trumpet.

Hautbois d'amour is similar to the preceding register, but it must be half-stopped, like the vox humana. It is generally an eight feet tone.

Hohl-flute (hollow flute) is a register now known in England by its German name. It is an open flue-register, of a wide measure, generally of wood, sixteen, eight, four, two, or one foot; in the two latter cases, the Germans sometimes called it siff-flute, especially the older organ-builders. The tone is full, and yet agreeable. As a sixteen or eight feet in the pedale, it is called hohl-flute bass; and as a two feet in the pedale, small hohl-flute bass. In the manual, as an eight or a four feet, it is sometimes called coppel-flute (coupling-flute). As a fifth-register, 5⅓, 2⅔, and 1⅓ foot, it is called hohlquinte (hollow fifth) or quinte-flute.

Holtz-flute (wood flute) is rather an indefinite name, which might be applied to several kinds of flutes. It is a register without any particular advantage or striking quality—eight feet, of wood.

Jubal-flute is an open flue-register, eight or four feet, which stands in the organ in St. Peter's, at Goerlitz, where it seems to take the place of an octave. The name of this register seems to have been given in honour of Jubal, the father of "all such as handle the harp and organ."[*] A Jubal-flute, eight feet, with double lips, stands also in the organ in St. Paul's, at Frankfort-on-the-Maine.

Kützial-flute is an open flue-register, four, two, or one foot, and is to be found also as a fifth, 1⅓ foot.

Genesis iv. 21.

Mixture, as a particular register, is of pewter or brass, has the same measure as the diapason, and repeats generally in the two upper octaves. To render this register serviceable, and to distinguish it from other mixture-registers, its ranks ought to be fifths or octaves. For instance, a mixture with three ranks ought to consist of 2, 1⅓, 1, or 1⅓, 1 and ⅔ foot; a mixture of four ranks, of 2, 1⅓, 1, and ⅔ foot; a mixture of five ranks, of 2, 1⅓, 1, ⅔, and ½ foot. We find sometimes mixtures with from six to eight, and in old organs, even with from ten to sixteen ranks, both in the manual and in the pedale. A mixture of so many ranks is a most absurd thing, for by the horrible noise it produces, the other registers lose their gravity and dignity, and the full organ produces nothing but a benumbing, stupifying noise. On the other hand, a well-constructed mixture is a very useful register, since it unites in itself several registers, as it were, neither of which could be used by itself, and thereby saves a deal of space. Besides, it gives to the tone of the organ, especially the full organ, fullness and power; distinctness and sharpness to the lower tones, more especially distinctness; and to the whole mass of tone a silver-like quality. In the repetition of a mixture, fiths and octaves must be used alternately.

Music-bass is a sixteen feet register, standing in the great-organ of the organ in St. Elizabeth's, at Breslau, extending from the lowest C of the manual to $\overline{e}$. But this register is merely obtained from the quintatön, and has no separate pipes.

Nacht-horn (night horn) or "pastorita," is an open or stopped flue-register in the manual and pedale, eight, four, two, and one foot, of a pleasing tone. Being of a wider measure than the quintatön, its tone is more horn-like. When open, this register is very similar to the hohl-flute, only that it is of a narrower measure than the latter, and has also a lesser height. In the pedale it is called night-horn bass.

Nasat, or ***nasad***, is an agreeable flue-register, which originated in the Netherlands. It is generally stopped, and a four or a two feet tone. Sometimes the pipes of this register have the form of those of the gems-horn, but with a wider measure, a narrower height, and with side-boards, particularly for the lower tones. Sometimes we find this register as a fifth of 10⅔ feet in the pedale, called the great nasat, and of 5⅓, 2⅔, and 5⅓ feet in the manual, called quint-nasat, or nasat-quinte. If, as is sometimes the case, the stoppers have tubes, then this register is called rohr-nasat (reed-nasat). The name nasat is derived from *nasal*, as the tone of this register is somewhat nasal.

Octave is an open labial-register of the same measure as the diapason, and contained in every organ without exception. Its size depends on that of the diapason, of which it is always the half. Thus it may be sixteen, eight, four, two, or one foot. But as, in England at least, the diapason is always eight feet, the octave of course is always four feet, thus sounding just an octave higher than the diapason. In the pedal-organ these registers are called *octave-basses,* sixteen or eight feet, or simply *eight feet,* as in England; or if four feet, *super-octave-basses.* Most octaves are made of pewter or brass, yet sometimes, especially in small organs, the eight feet and four feet octaves in the pedale are made of wood (see *Table VII, fig.* 9). The octaves are chiefly designed to support the diapasons, since they give the tones of the latter more freshness and roundness, and, more especially to the lower tones of the diapasons, more brightness and distinctness.

Petit (small) is a sort of flageolet, one foot, of pewter, seldom two or four feet.

Phys-harmonica is a newly-invented reed-register, with a soft, agreeable tone. It stands as a sixteen feet in the choir-organ in St. Mary's, at Wismar,—and as an eight feet (with vibrating tongues), provided with a crescendo and decrescendo, in the swell of the organ in St. Peter's, at Petersburg. It imitates an instrument of the same name, which was invented, in 1821, by Antonino Haerkel, of Vienna.

Piccolo, or "flauto piccolo" (a small flute), is a one foot register, of pewter, in imitation of the instrument thus called.

Portunal is a very agreeable, open flue-register in the manual, generally of wood, eight or four feet. The pipes are a little wider above than below. Its beautiful tone is of a very peculiar quality, similar to that of the clarionet, and well adapted to give to the other manual registers a certain denseness and fullness. When a four feet, it is sometimes called quer-flute or traverse-flute.

Principal, is in Germany the same as diapason in England, the Germans not using the word diapason at all. They distinguish between principal eight feet, principal sixteen feet, principal four feet, principal two feet, principal thirty-two feet and so on. In England the principal is always a four feet.

Progressio hormonica is a mixture-register, newly invented, by music-director Wilke, and recommended by him especially for smaller organs. This register begins with two ranks at the lowest tone of the manual (the two ranks being a third 1⅗ foot, and an octave 1 foot), and from C upwards (in the second space of the bass-clef) a third rank, octave two feet, is added. The measure of the pipes is something between that of the diapason and that of the cornet. The intonation is strong and the effect very fine. The tone of the organ becomes by this register distinct, full, and bright.

Pyramidal-flute, eight feet, of fine wood, stands in the choir-organ of the newly renovated organ in St. Peter's, at Liegnitz, in Silesia.

Quer-flute (traverse-flute), "tiffaro," or "flaut Allemande" (German-flute), is a flue-register of a particularly fine tone, imitating that of a real flute. Organ-builders in their endeavour to make this imitation as striking as possible, have essayed with this register all sorts of shapes and forms. The pipes are generally made of oak, pear-tree, or maple; they are either cylindrical or conical, open or stopped. Some organ-builders make the pipes twice as long as they ought be, and in order to make them over-blow (that is, sound an octave higher), they give them a narrow measure and a low height, or they allow a less portion of wind to pass into the pipes, by making the holes in the chamber feet very small. Other organ-builders bore out the bodies of the pipes, and provide them, on the place where otherwise the height would be, with an oval opening like that on real flutes, for blowing the wind into them. In this case, the wind passes to the pipes, not through their feet, but through tubes, which are so placed as to lead the wind immediately into the above-mentioned opening, and thus make the pipes sound. A similar arrangement was invented by Müller, of Breslau, and used in the organ of the great cathedral at Breslau. Here, the pipes of the quer-flute are provided with tubes, which indeed lead the wind through the feet of the pipes but immediately after, upwards along the body of the pipes into a hollow block of wood, which has a vertical cut, through which the wind passes out again into the oval opening of the flute, near the block. *Table VI, fig.* 17, represents a pipe of this kind. This register is in the manual an eight, four, or two feet, in the pedale a sixteen feet. Sometimes it is constructed like the portunal, or like the German-flute (flaut Allemande.)

Quintatön, " quintadena," or " quinta ed una," is in Germany a very common flue-register, stopped, of pewter, brass, or wood. In the manual it is an eight, four, or two feet tone, in the pedale an eight, or sixteen feet tone, called quintatön-bass, or great-quintatön. As a four feet it is very rare and little different from the nacht-horn. This register is of a narrower measure than the stop-diapason, it has also a narrower height, and is provided with side and traverse boards (see *Table VIII, figs.* 1 and 4). The intonation of this register is slow and the tone peculiarly cutting. Its most characteristic feature, however, is that the pipes, besides the fundamental tone or tonic, sound also the fifth, which lies twelve tones above that tonic, that is the twelfth, though of course this fifth is much feebler than the tonic. This has given rise to the name of the register, which implies a fifth, and a one (or a tonic). As a sixteen feet tone in the great-organ of some large organs, this register produces a fine effect, and gives to the whole volume of tone an extraordinary gravity and fullness.

Quint-viola, eight feet, stands in the great-organ of the new organ in Wittenberg. The properties of this register are unknown to the author. Perhaps it is a quintatön, of a similar intonation to that of the viola (tenor-violin).

Rausch-quinte (rustling-fifth) is a mixture register with two ranks, of pewter or brass. The two ranks are the fifth and octave, which in this way form a fourth, so that some organ-builders call this register, quarta (fourth). If properly constructed, it must consist of fifth 2⅔ feet, and octave 2 feet, or 1⅓ and 1 foot. Older builders used sometimes three ranks, or inverted the two ranks, placing the octave two feet below, and the fifth 1⅓ feet above.

Rohr-flute (reed-flute, see *Table VIII, figs.* 2 and 5) is a fine flue-register, of pewter, brass, or wood, stopped, but with tubes in the stoppers, in consequence of which the tone is brighter than in other stopped registers. To obtain a better intonation, the pipes are provided with side and traverse boards, and receive a wider measure than the quintatön. This register is in the manual an eight, four, two, or one foot tone, in the pedale an eight or sixteen feet tone, called rohr-flute bass. As a fifth, 10⅔, 5⅓ or 1⅓ feet tone, it is called rohr-quinta. There are rohr-flutes which, like the double-flutes, are provided with two lips, and produce a brighter tone than common rohr-flutes.

Salicional, or "salicet" (from the Latin *salise*, the willow, thus meaning a willow-pipe) is one of the finest organ registers; it exists, however, often only in name, and not in quality and character. It is an open flue-register of a narrow scale, therefore the pipes are a little longer than other flue-pipes of a wide scale, and a little wider on their upper end than below. As a good intonation is very difficult to be obtained from this register, the pipes of the middle and lower octaves are provided with beards (see *Table VII, fig.* 3). When constructed by a skilful master, this register produces a most lovely and delicate tone. As its intonation is rather slow, it can be used by itself only, for slower passages. The pipes are generally of pewter or brass, the larger ones sometimes of wood. In the manual it is a four, eight, or sixteen feet, in the pedale an eight or sixteen feet, called salicet bass. In some organs the salicet eight feet goes only through the upper octaves of the manual, the lower octaves being either wanting altogether, or replaced by some other eight feet.

Schalmei, or "shalm," is a soft, agreeable reed-register, in imitation of an instrument of this name, used by the shepherds of southern Europe. It stands both in the manual and in the pedale (schalmei-bass), as a four, eight, or sixteen feet. The bodies of the pipes are generally funnel-shaped, but of a wider measure than those of the trumpet. The tone of this register varies as much as the structure of its pipes. Sometimes the pipes are even stopped, with the exception of a few sound-holes.

Scharf, or "sharp," is a mixture-register, which differs from the mixture by one of its ranks being a third. We find it with three, four, or five ranks. With three ranks it consists of an octave 2, third 1⅗, and fifth 1⅓ feet. With four ranks, of an octave 2, third 1⅗, fifth 1⅓, and super-octave 1 foot. With five ranks, of fifth 2⅔, octave 2, third 1⅗, fifth 1⅓, and octave one foot. The pipes are of pewter or brass, the intonation is like that of the diapason, the measure narrower than that of the diapason, and the effect of the whole register cutting and filling out. Wilke proposes to have the pipes of the higher tones of a wider scale, to obtain greater fullness of tone.

Schwiegel or " stamentin-pipe (see *Table VII, figs.* 7 and 8) is an open flue-register of a narrow scale, with a narrow height. The pipes are of pewter or brass, cylindrical in the middle, and conical at the upper end. The tone is very agreeable, similar to that of the quer-flute. Its size is eight, four, two or one foot. Sometimes it runs only through the upper octaves of the manual. As a two or one foot it is sometimes called a flageolet or larigot.

Swiss flute is an open flue-register, of pewter or brass, eight, four, two, or one foot. Its tone is similar to that of the gamba, and very agreeable. As it is difficult to obtain from the pipes a good intonation, they are provided with side and traverse beards, and, in the upper octaves, are of a somewhat wider scale. It stands both in the manual and pedale. Sometimes it goes only through the upper octaves of the manual. Its intonation being rather slow, it is only adapted for slow passages.

Serpent is a reed-register seldom to be met with (sixteen feet in the pedale), the tone of which is stronger than that of the bassoon, but weaker than that of the trombone. It imitates the instrument of the same name.

Sesquialtera, or *zinc,* is a mixture-register with two ranks, of pewter or brass, and of the same scale as the diapason. The two ranks are a *fifth* and a *third,* the latter being raised an octave, properly, therefore, a *fifth* and a *tenth.* In this way these two intervals (the tenth above the fifth) form together a *sixth,* or *sexta,* whence the name sesquialtera. It consists generally of fifth ⅔ and third 1⅗ foot. In some few organs it has three ranks, viz., octave 4, fifth 2⅔, and third 1⅗ foot, and in others even four ranks, with an octave two feet added.

Sordun, or *sordun bass,* (from the Latin *surdus,* meaning " deaf, quiet, subdued,") is a stopped reed-register, sixteen or eight feet tone in the manual and pedale, of a feeble but agreeable tone. It is now obsolete.

Spill flute, or *spindle flute* (see *Table VII, fig.* 8), is an open flue-register, eight, four, or two feet, which derives its name from the narrow scale of its pipes. The pipes are of pewter or brass, provided with side-beards, cylindrical in the middle, and conical at the upper end.

Spitz flute (pointed flute), "flauta cuspida," is a common open flue-register, of an agreeable tone, with conical pipes of pewter or brass—in the lower tones sometimes of wood. The pipes are more pointed than those of the gems-horn, and have also a wider height. In the manual it is an eight, four, two, or one foot; in the pedale, a sixteen feet, called *spitz flute bass.* This register is also a fifth, sometimes 2⅔ or 1⅓ foot, called *spitz quinte.*

Tenth, or "decima," is a register ten notes higher than the octave four feet, or a third higher than the octave two feet.

Terpodion is a newly invented instrument, by Bushmann, on which the tone is produced by sticks of wood. An organ-register of this name, eight feet, of pewter, stands in the fourth manual of the organ in the cathedral at Halberstadt (built by J. F. Schulze), where, in conjunction with the stop-diapason sixteen feet and eight feet tone, and with the harmonica eight feet, it resembles the wood instrument, invented by Bushmann.

Tertian is a mixture-register of two ranks, which have the inverted position of the sesquialtera; the third being below, that is, larger than the fifth. The tone is still sharper than that of the sesquialtera. It consists either of a third 3⅕ feet, a fifth 2⅔ feet, or a third 1⅗, and 1⅓ foot. In some few old organs it consists of three ranks, viz., octave 4 feet, third 3⅕, and fifth 2⅔ feet.

Third, or "tertia," is one of the secondary or filling-out registers, of pewter or brass. It is an open flue-register, 3⅕, or 1⅗ foot, and sounds, as its name implies, a major third above the tonic; for instance, if the key f is pressed down, the tone a is produced. In old organs we find it sometimes also in the pedale.

Trinona is a sweet, open flue-register, of a narrow scale, and a gamba-like tone. It stands as an eight and four feet, of wood, in the manual of the organ in St. Vincent's, at Breslau.

Trombone is a well-known register, in imitation of the instrument bearing its name. If properly constructed, it is the strongest and finest reed-register of the pedale. It is an eight, sixteen, or thirty-two feet. The bodies of the pipes are generally of wood, having the form of inverted pyramids (see *Table VII, fig.* 8). Yet sometimes we find even the largest pipes of thirty-two feet trombones composed of pewter (as is the case in several organs at Hamburg and Copenhagen), having the form of inverted cones. The scale of the pipes is wider than that of the trumpet. The bodies of the pipes are never of the exact length stated, as is the case with all reed-registers, because the mouth-piece, the tone-producing part of the pipe, is always included in the length. In old organs, we frequently find in the pedale a trombone eight feet, and at the same time a bombardon sixteen feet. In the new organ in St. Peter's, at Petersburg, there is a trombone eight feet even in the manual.

Trumpet, tromba, clarino, is a very well-known and useful reed-register, of pewter, brass, or wood, sixteen, eight, or four feet, both in the pedale and in the manual. In the manual it is the strongest and finest reed-register. The pipes are of a narrower scale than the trombone; the mouthpiece, tongue, and all that appertains to it, are likewise smaller than that of the trombone. Sometimes the bodies of the pipes are, in the upper octaves, of pewter or brass (see *Table IX, fig.* 6), in the lower octaves of wood. This register often runs only through the upper octaves of the manual, beginning at c. In the manual the trumpet is generally an eight feet, sometimes a sixteen feet. In the pedale it is almost always an eight feet, sometimes combined with a trumpet four feet, which is then called clarion.

Twelfth, or "duodecima," is a fifth raised an octave, or half the size of a fifth.

Unda maris (wave of the sea), is an open flue-register, of pewter, brass, or wood, eight feet, which is tuned a little higher than other registers, whereby a peculiar tone is produced, reminding one of the soft waving of the sea. This register is, however, constructed also with double lips, like the bifara. It cannot be used by itself, but only in connection with some other soft register, or else the waving of the tone would not be perceptible.

Viola is an open flue-register, eight or four feet, of a narrow scale, imitating the tone of the tenor-violin or viola. The structure and tone of this register are similar to that of the Swiss flute. As a four feet, it is sometimes called violet, and as a fifth 2⅔ feet, quint viola.

Viola d'amour is a flue-register, eight or four feet, similar in structure and tone to the gamba or salcional. Some consider this register as identical with the flute d'amour. Sometimes the pipes are conical, like those of the gems-horn.

Viola di gamba, or simply *gamba,* is one of the finest registers. It is an open flue-register of a narrower scale than the salcional. The pipes have a narrow height, and in order to make them overblow, they are made longer than those of the diapason and of the salicet. Their intonation is somewhat slow, whence they are provided with side and traverse beards. In some few cases the pipes have conical bodies (*Table VII, fig.* 5), and then this register is called a conical gamba. So shaped, the tone is less cutting than if the pipes were pyramidical. When well constructed, the tone of this register is peculiarly charming, and strikingly imitative of the tone of the tenor-violin. By reason of its slow intonation, it is less adapted for quick passages than for slow ones. In some few instances this register goes only through the upper octaves of the manual. In order to obtain from it a very delicate and mellow tone, it should be composed of pure English pewter; sometimes, however, the pipes are made of brass, and in the lower octaves of wood. As a sixteen feet for the pedale, this register is called gamba-bass. *Fig.* 2, on *Table VII,* represents a gamba-pipe, showing at the same time its size and measure in comparison with the diapason and salicet.

Violin principal is an eight or four feet register, with an agreeable, violin-like tone.

Violin is an open flue-register, of pewter, two feet, similar in tone to the octave.

Violon, violone, or *violon-bass,* is one of the finest and most common pedal-registers. It is an open flue-register, of a narrow scale, the pipes of which are a little wider at the upper end, and, in order to obtain a good intonation, provided with side-beards. When well constructed, the tone is very fine and agreeable, and imitates the tone of the great double-bass. Its usual size is sixteen feet, thus agreeing in pitch exactly with the double-bass. In some organs this register is only an eight feet, and then called violoncello. Some consider this register to be identical with the gamba-bass; but this is not the case, as the violon is of a wider scale, and the latter, when beginning to speak or sound, produces first the octave before it produces the real tone, whilst the gamba-bass sounds first the real tone, and then its octave.

Vox humana (human voice) is a reed-register, intended to imitate the human voice, but seldom resembling it any more than other reed-registers, in spite of the many experiments which have been made to this end. Wilke, however, asserts that the vox humana in the organ at Brenan, extending from F in the bass (below the stave) to $\bar{c}$, imitates the human voice so strikingly, that one might fancy he hears alternately a bass and a tenor singer. This register originated in the bear's pipe. The bodies of the pipes (see *Table IX, fig.* 18) consist of two funnels soldered together. The pipes are of pewter, brass, or wood, and of the most varied shape. Some organ-builders make the bodies of the pipes cylindrical. The top of the foot sticks in the head of the mouthpiece. The pipes are stopped by a round brass plate (see *Table IX, fig.* 8) with a round hole in it, the latter becoming, towards the upper notes, gradually larger and larger, so that in the highest notes the stopping ceases altogether. In the upper manual of the organ in the church of St. Mary Magdalen, at Breslau, there is a vox humana from C in the bass (second space in the stave) upwards, which has wooden pipes, wider above than below, and stopped in the way already described (see *Table IX, fig.* 17). The stopping ceases at $\bar{\bar{c}}$, and the following higher tones commence with pipes of the same size as that of the octave from $\bar{c}$ to $\bar{\bar{c}}$, but of a narrower scale. Imitating the human voice, the natural size of this measure is of course eight feet; but we find it sometimes as a four feet, when it is called vox virgina, or vox angelica. Generally, the vox humana goes only through the two treble octaves; but sometimes it commences at C in the bass (second space on the stave). In the Netherlands this register is sometimes called bear's pipe, or krumm-horn (crooked horn).

Vox retusa, eight feet, of pewter, is a flue-register, standing in the upper manual of the organ in the cathedral at Lund, in Sweden. Retusa is an old term applied to stopped pipes.

Vox vinolata is a flue-register, eight feet, of brass, of a narrow scale and weak intonation; it stands in the same organ as the foregoing register. How the term vinolata, which is derived from *vinolentus*, "drunk, tipsy," is applicable to an organ-register, is difficult to explain.

Wald flute (wood flute) "tibia sylvestris," is an open flue-register of a wide scale, eight, four, two, or one foot. In the tone of this register there is nothing peculiar; it is rather broad, woody, and hollow. As a fifth 5⅓, 2⅔, or 1⅓ foot, it is called wald quinte. This register is at present very seldom constructed.

Wald horn (bugle horn, French horn) is a rare reed-register, in imititation of the instrument thus called. It stands both in the manual and in the pedale, as an eight, four, or two feet. As yet, no organ-builder has ever succeeded with this register. Wilke thinks that the tone of the French horn would be more easily imitated by flue-pipes than by reed-pipes. The tone of the flutuan (see page 98) approximates very nearly to that of the French horn.

Zart flute (soft or tender flute) is a register which stands in the organ of St. Mary's, at Wismar. It was invented by the organ-builder Turley, who called it first a gamba; but as it little resembles the tone of a gamba, but much more that of a fine, soft flute, Wilke advised him to call it zart flute. The pipes are of a narrow measure and a narrow height; they are composed of pure English pewter. *Table VI, fig.* 18, represents a pipe of this kind. The curved line indicates the space left for the emission of the wind.

PART VI.

THE TREATMENT, PRESERVATION, AND SUPERINTENDENCE OF THE ORGAN.

CHAPTER I.

GENERAL AND SPECIAL OBSERVATIONS ON THE ART OF REGISTERING.

By registering, we here understand, the mode in which the various registers of an organ are combined for certain ends. A judicious application and an ingenious combination of the various registers, are things which every organist should eagerly strive to attain. As the painter and the instrumental composer produce their effects, the former by an appropriate choice of colors, the latter by a judicious combination of the various instruments, so the organist who handles an instrument which represents or unites in itself a whole orchestra, must produce his effects by an appropriate and judicious choice of registers. The first condition of a good registering is a perfect knowledge of the size and character of the different registers. As we have already seen, there are registers which can be used by themselves as well as in combination with others, whilst there are others (the secondary and mixture-registers), which can only be used in combination with the former kind, but never by themselves. The latter class of registers merely serves to strengthen and sharpen the others. The most useful registers, especially for supporting the singing of the congregation, are, in the manual the eight feet, and in the pedal the sixteen feet, the latter forming the bass of the former. If the organist wants to obtain a stronger tone he must draw some additional registers, viz, in the manual the four feet, and in the pedale the eight feet. To obtain a still stronger tone, the so-called secondary registers (fifths and thirds) must be added, but then care must be taken, lest one of the latter should form the highest or smallest one in a combination of registers. For example, if the diapason eight feet, together with some other eight feet, and some four feet (for instance the octave) are drawn, the fifth 2⅔ feet cannot be added, unless the super-octave (or fifteenth) two feet is added too, or else the fifth would be the highest register, and the interval of the fifth would become so prominent and so dissonant, that the ear would be unable to sustain the unpleasant effect produced thereby. *Every fifth or third must be covered by some higher register.* To obtain the strongest possible tone, all the other registers, especially all mixtures and reed-registers, are drawn out too. Thus we have:—

1. *For a feeble tone.*—In the manual all eight feet, and in the pedale all sixteen feet flue-registers.
2. *For a strong tone.*—Besides the foregoing registers in the manual, all four feet; in the pedale, all eight and, perhaps, thirty-two feet; or, for a change, the various reed-registers might be used.
3. *For a strong tone.*—Besides all the preceding registers in the manual, all thirds, fifths, two and one foot; in the pedale, all thirds, fifths, and four feet, and also, if any, two and one foot. The two and one foot might also be omitted and spared for the full organ.
4. *For the strongest tone possible.*—The full organ, that is, all the registers contained in an organ.

Now, *with respect to the full organ,* some say that it is unnecessary to draw for the full organ any of the softer or weaker registers, as they are completely drowned by the stronger ones, producing therefore no effect, but serving only to waste the wind. They also maintain, that registers of the same size should never be exclusively combined together, as this would produce a very monotonous tone, and further, that registers with a slow intonation, or speaking, should never be combined with those of a quick intonation. These objections are partly refuted by the consideration that the organ is to represent a full orchestra. Compositions for the orchestra we find interspersed with solo passages, executed by *one* kind of instrument only, for instance, by the stringed-instruments or by the wind-instruments. Besides, it is not true that the weaker flue-registers contribute nothing at all to the total effect of the organ; on the contrary, they greatly serve to enrich and ennoble the whole mass of tone. In many old organs there is but one eight feet register (stop diapason), forming the basis of a great number of 4, 2, 1⅓, and 1 foot. Though such an arrangement is, of course, not admirable, yet the old builders were well aware of the filling-out nature of the stop-diapason. Is it not a fact that the bourdon sixteen feet tone imparts a great gravity to the tone of the manual, and that the feeble sub-bass sixteen feet, produces, nevertheless, a very good effect, when used in the full organ? It is no more wrong to combine several eight feet together, or several four feet, than it is wrong to have the first violin part of an orchestral composition executed by a number of violin players, instead of by one only. As to the combination of registers of a slow intonation with such as are quick, it is a fact that the former, when combined with the latter, speak or sound more easily and quickly. Besides, of a good organist, it is to be expected that, in using the full organ, he will never execute such quick passages as could not be likewise executed with any of the registers singly.

From this it follows that the organist has to attend particularly to the following:—

1. That one register always supports the other; the larger and deeper registers receiving from the smaller and higher ones greater clearness and distinctness, and the latter from the former more solidity, roundness, and mellowness. Thus, in any combination of registers, the majority ought never to consist of the smaller registers, but always of the middling or larger ones; though, in this too, a certain medium must be observed, because too many large registers would render the tone rather indistinct or confused.

2. That in the progression of registers no interval or gap must be perceived. It would be wrong to draw in the manual one or more eight feet, together with one or several two feet, omitting the four feet; or to draw in the pedale some sixteen feet and four feet without the eight feet.

3. That the nature or character of the various registers must be

properly regarded. Thus it would be injudicious to strengthen an eight feet by a stopped four feet and an open two feet, because, in such a combination, the open four feet would be greatly missed. From this rule the organist might depart, if he intended to execute upon one manual, with one or several two feet drawn, some quick passages, which he would accompany upon the other manual with an eight feet. In this case the four feet might be dispensed with. Or, suppose the pedale contains a trumpet eight feet, a trombone sixteen feet, and another thirty-two feet; in order to make the trumpet very prominent, the trombone thirty-two feet might be combined with it, the sixteen feet trombone omitted, and some flue-basses substituted for it.

The number of pedal-registers to be drawn depends on that of the manual registers. To three, four, or five manual-registers, we may reckon one, two, or three pedal-registers, though this again depends of course on their size, strength, and character, and particularly on their being open or stopped. To avoid monotony, the tone of the organ must not always be strong or always weak. The strength of tone depends chiefly on the number of singers at church, and on the tendency of the ritual solemnity. For services of a mournful character, the organist has at his disposal all the eight feet and the soft stopped four feet registers;—the open four feet, such as the octave or principal, would be too loud and penetrating. In the pedale, eight and sixteen feet may be used. In larger churches, the octave and principal may likewise be drawn. Should a large organ contain in the manual a bourdon, a quintatön, and a diapason sixteen feet, these registers, augmented by the octave, to render the tone distinct, would do very well for such occasions. In the pedale, the trombone sixteen feet and trumpet eight feet, or some other eight and sixteen feet reed-registers might be drawn. For variety's sake, it would be advisable not to play all the strains or verses of a hymn with the same registers, but to play one strain a little louder, another a little weaker, and so on. For solemnities of a more cheerful character, the first and last strain of a hymn might be played with the full organ, the other strains with the full organ, save the mixtures. But then care must be taken, lest some fifth or third should form the highest register. So in the pedale, the highest register should not be a fifth, but the super-octave four feet. On such occasions the preludes and postludes are usually played on the full, or at least with a strong organ.

Here follow some special observations on registering, as far as they are applicable to English churches, several of the author's remarks on this subject having been omitted by the translator, as being too minute, and too much appertaining to the rites of the Roman Catholic church in Prussia. If a hymn is to be sung, the melody of which is unknown to the congregation, the organist, if he has an organ with two manuals, would do well to play with one hand nothing but the melody upon that manual which contains some very strong registers, such as the trumpet eight feet, whilst with his other hand he plays the accompaniment upon the other manual, for which he draws but a few soft registers. For variety's sake some organists play the hymns with variations. The first strain they generally play with the simple harmonization, as contained in the hymn or choral book, so as the better to impress the melody; the second strain they play with variations, for the left hand alone, or for both hands, taking care, however, that the right hand at all events plays the melody also. In the next strain they play the melody in the tenor with the left hand, an octave lower than it is written, upon a manual which contains some very strong registers, whilst the right hand plays some variations upon a manual which is but feebly registered. Sometimes they place the melody even in the bass, for which purpose they use a trombone or a bassoon sixteen feet. On organs with only one manual, such variations on chorals or hymns cannot be executed.

If the organ takes part in the church music merely to accompany, one single stopped eight feet for the pedale, and one stopped sixteen feet tone (or perhaps with an additional eight feet) will suffice. But should it happen that the basses in the instrumental music are too weak, or wanting altogether for want of performers, the organist must strengthen the pedale by some more sixteen and eight feet, or by the pedal-registers altogether, with the exception of the reeds. If, in the course of the music, a solo for the organ occurs, the organist must draw for his manual a gamba or salicional in addition, or, if the organ should not contain these registers, a second stopped eight feet, or a gems-horn eight feet, or the open diapason alone. For the pedale he might draw the violon (or subbass) sixteen feet, and violin (or octave-bass) eight feet. For the accompaniment of recitatives, which frequently occur in church music, the registering may be nearly the same as for the execution of organ solos. Reed-registers should never be used for the accompaniment of church music, except some wind-instrument, the hautboy for instance, is wanting in the orchestra; in this case the organist might draw his hautboy register, and execute the part written for the real hautboy. But then it is absolutely necessary that the registers should be accurately tuned and free from all faults of intonation.

If the organist registers but weakly, drawing perhaps only two or three registers, he must take care not to combine solely such registers as have the same intonation or the same character of tone; or else the effect would be about the same as if a picture contained only light without shade or shade without light. On the contrary, registers of a different character augment, support, and soften each other. The Gamba and salicet, when combined without any additional register, make no agreeable impression upon the ear, though both are reckoned the finest registers, whilst one of them, combined with a stop-diapason or with a flute eight feet, would produce a much finer effect. In the same way the salicet and quintatön is not a judicious combination, whilst the quintatön and gemshorn produce a very good effect. For similar reasons it is not advisable to use reed-registers exclusively, without any flue-registers, because their tone is too braying and incoherent (or incompact), and requires, therefore, the aid of some flue-register to become mellow and dense (compact).

CHAPTER II.

WHAT IS INJURIOUS TO AN ORGAN.

It is sad to see in what a wretched condition this sublime instrument is often left, owing simply to the deficiency of the organist's knowledge in all that appertains to the preservation of his instrument. With a view of removing this deficiency we shall endeavour to throw out to organists such hints as will surely prove beneficial, provided they are diligently applied. Injurious to an organ are:—

1. *Damp* and *wet*. In a rainy winter, and particularly towards spring, the wood-work of the organ swells so considerably, especially if the church is not carefully closed up, that the stops are difficult to be drawn, and the copulas difficult to be moved. The trackers begin to stick and occasion a fearful howling of pipes; the palates in the great sound-board are difficult to be removed in the case of some defect in the wind-chest requiring attention. Wooden pipes or bellows, when placed near damp walls, lose the glue with which the little crevices are covered, so that these crevices are now open, and allow a portion of the wind to escape. The iron-work of the organ, and especially the tracker-wires, are partly or wholly destroyed by rust, and even the tuning is influenced by damp and wet, since the heights of the wood-pipes become narrower, so that the requisite portion of wind can no longer pass through, in consequence of which these wood pipes become, in comparison to the pewter pipes, too flat, or they sound but imperfectly, and often not at all.

To prevent, from the very beginning, this detrimental influence of damp and wet, some rules must be already observed in the first erection of an organ. The back of an organ should not be placed too near the wall; or if this becomes necessary for want of room, the wall must be properly wainscoted. The doors and windows in the vicinity of the organ must be kept in good order and properly shut up, so as effectually to exclude both snow and rain. The same is to be said of the ceiling of the church. A special care must be bestowed on the bellows, if they are placed in a separate room, apart from the organ. In the neighbourhood of the organ and of the bellows-chamber there ought to be some windows, partly in order to let out the dust arising when the church is cleaned, partly in order to replace the damp and corrupt air often contained in churches, by a drier and healthier one. If a church should be particularly damp, the organist can, partly at least, though not completely, save his instrument from the fatal influence of damp, by frequently opening the windows of the church. But this he must not do indiscriminately on any day. It would be very erroneous to suppose that the windows may be opened on any fine, bright day. In spring, for instance, when the snow is melting, and when in general the air is fraught with damp, it would only make the evil worse, if the church windows were opened, however brightly the sun might shine. Thus, the organist must always regard the quality of the atmosphere and the direction of the wind, before he opens the windows. When the wind and atmosphere are cold and dry, such are the moments he must wait for. Should he perceive a mouldering scent in the church, the organist would do well to open all the entrances to the organ; at all events, it should be considered an inviolable rule, never to change the temperature of the church too suddenly.

2. *Draught* is particularly injurious to reed-registers, causing them more or less to get out of tune. It must be especially observed that in order to avoid the bad consequences of a draught, the windows should never be open during and after the act of tuning, but rather before, if it should be required at all.

3. *Sunbeams and heat* influence the tuning of an organ, and injure also some of its parts. The rays of the sun when falling upon the front pipes, which are generally of pewter, expand the latter, and make them sound higher than the other pipes, till the sunshine ceases and the pipes resume their former condition. But it is of course better to avoid this inconvenience altogether, and to take care in the erection of an organ not to place the instrument so as to allow the sunbeams to fall upon the pipes. If however this fault once exists, it may be remedied by protecting the pipes by a curtain, which must not be of a green or a dark, but rather of a white colour. Much greater, however, is the injury when sunbeams penetrate to the interior of an organ. In such a case the wood pipes, grooves, bellows, and the doors of the organ, very often get cracked or otherwise severed, since the glue by which they are kept together is dissolved by the heat. The leather on the bellows, too, gets damaged, inasmuch as it becomes dry, and consequently apt to break and tear. In this case the fault may be remedied by a curtain, or by a total removal of the window or other opening through which the sunbeams fall in. Besides the injuries mentioned already, the ledges of the sucker on the bellows, and the upper-boards, very frequently warp so considerably, that the stops are very difficult to be drawn. The wooden trackers get extended and otherwise altered, in consequence of which, the pedal or manual-keys to

which they are connected, change their position, so that in the row of keys the one stands higher, the other lower, and so on. Sometimes manual-keys of linden wood become quite crooked, so that they cannot be pressed down, without pulling down at the same time the adjoining keys, or they stick all together, moving neither up nor down. The tuning of the wood pipes, too, is very much influenced by heat, for as heat makes the wood shrink, the wedges of the pipes become enlarged, and the tone in consequence becomes higher. The same is the consequence when the stoppers shrink and sink deeper into the pipes, or when the upper lip, especially of large pipes, begins to warp. The reed-pipes more especially suffer greatly by heat, as their tongues which are of brass become expanded, in consequence of which the vibrations become slower and the tone lower. The bellows in very hot weather frequently act quicker than at other times. This is owing to the expansion of the pores, and to the shrinking of the palates, in consequence of which some portion of the wind escapes. Should an organ in general suffer by heat, it would be as well to wet every day those parts of the church, which immediately surround the organ with a pretty good quantity of fresh water, whereby the warm temperature in the church would be diminished, and a beneficial moisture produced. Keys which have become crooked will become straight again by being wetted, or wound round with a wet piece of cloth for a night or two.

4. *Cold* influences the tuning of an organ in a way opposite to that of heat. Whilst the latter makes the tone higher, cold makes it lower, since it fills out the pores of the pipes, in consequence of which the pipes become denser and larger, and produce a lower tone. This however applies only to flue-pipes, for since in reed-pipes the height of the tone depends less on the vibrating column of air, than on the quality, especially elasticity, of the tongue, cold increases the elasticity of the tongue, in consequence of which the vibration becomes quicker and the tone higher. It often happens that in very cold weather it is impossible to tune the larger reed-pipes lower than they are, because the tuning-crook already reaches up to the reed in the mouthpiece. To effect a lower pitch of the pipe, it becomes necessary, in such a case, either to lengthen the beak and tongue by drawing them a little further out of the mouthpiece

(this is of course only possible when the mouthpiece consists of more than one piece), or by covering, or partly stopping the upper aperture of the pipe with a piece of wood. Sometimes it suffices to bend the tongue nearer to the mouthpiece.

5. *Dust and dirt* are particularly injurious to an organ. Dust having generally a tendency to rise, very often remains in large quantities in the higher parts of the organ. It is particularly dangerous to the smaller metal pipes, especially to all kinds of mixtures, which often become so completely filled with it, as to be altogether incapable of sounding. It might be expected that the wind passing through the wedge of the mouth into the pipe, would drive out this uninvited guest; but then as damp and wet too, find their way to the pipes, the dust is frequently changed into a sort of paste, and gradually into a solid mass, capable of bearing a new stratum of dust. In the same way dust accumulates about the mouthpiece of the pipe, whereby the wedge of the mouthpiece becomes narrower, and the tone lower, feebler, and less clear. To wood pipes dust does not do so much damage as to brass and pewter ones. Though it is of course in no one's power to protect the organ from all dust and dirt, yet a deal may be done to this end, by observing the following rules. In sweeping and scouring the church, the latter ought to be properly besprinkled with water, or strewn with wet sand or saw-dust. Still better would it be to remove the dust by wet wiping-clouts. In scouring the immediate neighbourhood of the organ, care must be taken to do the thing as slowly and gently as possible, lest the dust should fly upwards and fall into the pipes. It would also be as well to play upon the organ till this business is over, drawing all registers, and using all the keys, so that the wind in the pipes would resist the entrance of dust. This plan, however, is only practicable in those instances where the bellows lie in a room or chamber apart from the organ, else the dust would get into the bellows through the suckers, and from them through the palates, &c. into the pipes. For this latter reason it becomes particularly necessary to brush the bellows on all sides, and to keep the bellows-chamber clean from all dust and dirt, especially from feathers, cobwebs, &c. lest the latter should penetrate to the pipes and cause an imperfect intonation, or lest they should stick to the palates and prevent them from closing properly, the consequence of which

would be a howling or humming of some of the pipes. When the bellows-chamber has been cleaned, the bellows must not be used until all dust has disappeared. Here too, the strewing of wet sand or saw-dust, or the use of wiping-clouts is to be recommended. As the air passing through the suckers into the bellows frequently carries with it all sorts of light bodies, such as cobwebs and the like, it would be well to encompass the sucker from without with a fine net of hair. If the organ should be so completely filled with dust that a number of pipes do not sound at all, or but faintly, it then would become a matter of necessity to take the whole of the pipes out, and commence a thorough repair.

6. *Cobwebs and feathers* affect the intonation of the pipes and also their pitch. Sometimes the cobwebs extend over whole rows of pipes, covering the apertures, and causing thereby, especially with open pipes, a flatness of tone. These cobwebs are often broken either by damp, or by dust falling upon them, and then they fall, partly or wholly, into the pipes, and cause a faint intonation or a complete cessation of tone.

7. *Insects*, and especially the *wood-worm*, very often damage an organ to a considerable degree. The wood-worm invariably visits all those organs, the respective parts of which are composed of bad wood, that is, of wood which has not been sufficiently dry, or not properly impregnated with lye, and then it is more especially the softer part of the wood, between the bark and the centre, which is exposed to destruction from this source. Pipes of such wood are gradually so completely eaten by the wood-worm, that the wind blows out the dust or wood-meal through all the holes, in consequence of which the intonation becomes less perfect, or it ceases altogether; especially if the foot of a pipe has been damaged, so that a considerable portion of wind escapes through the worm-holes before it reaches the body of the pipe; the bellows, grooves, and wooden conductors, frequently share the same fate. Brass and pewter pipes, too, when receiving the wind from damaged conductors, lose their proper intonation, since the wood-meal is driven into them by the force of the wind. Even the organ-case, the doors, and stair-cases are not exempted from this kind of destruction, which often ends in a thorough destruction of the wood-work, and a complete cessation of tone. In this latter case, no other remedy

is left but a rebuilding of the wood part of the organ, and a careful removal of all damaged wood. Single wood pipes, which have been thus injured, may be repaired by all the worm-holes being carefully glued over with strong paper, and the latter varnished with glue and bole. The lips and feet, too, of such pipes must be closely examined, and, if necessary, removed. The same means may be applied to damaged bellows, grooves, &c., although these remedies will be but temporary, as the worm, when once abiding in an organ, can never be completely expelled from it. *Mice* and *rats* destroy, by knawing, the feet of bad brass pipes, that is, brass pipes of a composition in which the lead is disproportionately predominant. It is a known fact, that the oxygen contained in the atmosphere is imparted to bad brass, and produces what is called lead-sugar, a substance which is eagerly sought and consumed by mice and rats. Pastor Dobermann, in a periodical of his, narrates that, a few years ago, the king of the Isle of Placida desired all house-owners to kill their cats, as they were dangerous to his pheasantries. The consequence was, such a dreadful propagation of rats, that everything was eaten up by them, even the organ-pipes in the church. Wilke, too, found in an organ the mixture-pipes (mostly of pewter) eaten by mice. Pipes, thus damaged, very frequently break, and in falling, injure some of the adjoining pipes too. To repair this damage, and to check at the same time the rapid increase of these animals, nothing better can be done than to substitute for the bad brass and the damaged pipes, good brass and new pipes. *Moths* destroy the leather-work of an organ, especially if the softer part of the leather is turned outside. These insects are generally found as larvæ, wrapped up in a sort of web between the wood and leather, in the vicinity of the stoppers. The real moth destroys, more especially, the pieces of felt or cloth which are laid under the keys of the pedale and manual, in order to prevent their rattling. To protect these pieces of felt and cloth from such destruction, nothing is more efficient than to rub them well in ground pepper, the smell of which is insupportable to moths. This proceeding must be periodically repeated (as the scent evaporates in the course of time), the old pepper-dust having first been removed. Wilke proposes to dip these pieces of felt or cloth in a solution of arsenic. *Bats* sometimes hide themselves in organ-pipes, and thereby cause an imperfect intonation, or a cessation of sound. It often happens that the bats get into such reed-pipes as are narrower below than above, and being unable to use their wings in order to extricate themselves from this fatal position, they are doomed to die; the consequence is a cessation of tone, or an indistinct whizzing of the pipe. Here the remedy is, of course, very simple. Sometimes swallows and sparrows meet with the same fate. To prevent such mishaps with the larger pipes (sixteen and thirty-two feet), which are difficult to handle, it appears advisable to place over the aperture of these pipes a net of iron or brass wire, which, however, must not be too fine, as this would injure the tone. *Flies* and other small insects soil the polished surface of the front pipes, or they get between the tongue and the beak of the reed-pipes, in which latter case a slow, indistinct intonation is the consequence. Sometimes these insects make their way through the sucker of the bellows, the palates, grooves, and other wind-conductors into the pipes, occasioning thereby the same fault in the intonation. In both cases the remedy is very simple: either the application of a feather, or a strong blowing into the pipe, will drive out the obnoxious object.

8. *Careless or curious persons*, especially those who clean the church, often damage an organ; it would be desirable, therefore, that those persons should be overlooked by the organist, or by some other confidential person. *Violent knocking or shaking* in the neighbourhood of the organ should be scrupulously avoided, as it injures the tuning of the organ. This is especially the case in hot weather, when the stoppers begin to shrink, and, by shaking or knocking, are easily driven deeper into the pipes, causing thereby an over-sharpness of tone. An unnecessary *touching or taking out of the pipes* is likewise injurious, as the pipes are very easily bruised or bent. Besides, if a pipe, after having been taken out, is not replaced exactly in its former position, it will sound too flat or too high, too strong or too weak. Children, and persons who do not understand anything about the matter, should never be admitted to the interior of an organ, except in the presence of the organist. The *organ-blower*, when carelessly or inconsiderately doing his duty, can do an irreparable injury to an organ. By careless blowing, the organ gradually arrives at such a condition that the wind is no

longer produced in even, equal portions, but in shocks, and the tone assumes quite a whining character—a fault which can only be remedied by a thorough repair of the organ. In handling the bellows, the organ-blower must avoid all shocks or jerks; and he must draw up the bellows as gently and evenly as possible, because all shocks are immediately imparted to the tone, which assumes, besides, a moaning, sobbing character. The bellows must have completely sunk down before he draws them up again, and the drawing up, too, must be done completely, not partly. During the act of tuning, more especially, the bellows must be handled very gently and evenly, lest an uneven or unequal force of wind should be produced, which might very easily mislead the tuner. The bellows-chamber must be scoured from time to time. It would be well if the organist would now and then secretly observe the organ-blower during his work, to convince himself whether he has the right mode of blowing; at all events, an organ-blower who has just been chosen for his work ought to be properly instructed by the organist, either verbally or by writing. Finally, the *organist himself* can damage an organ in various ways; first of all, by a *too strong or violent playing*, or rather thumping. The consequence of this is, that some of the palates are thrown out, or their springs are displaced or thrown out, or some of the trackers overthrown, or the pusher on the bellows thrown out, or the purses and trackers otherwise damaged. Besides, it is a nuisance in the church, and a great offence to the congregation, if the organist raves upon the organ as if he were mad, working away with his hands, feet, and his whole body, as if he were employed in extinguishing a large fire. Now, in this respect, the translator has never seen the organ more abused and more wretchedly handled than in England. Comparatively speaking, there are but few organists in England who have regularly learnt the art of playing the organ, and still fewer that know anything about the mechanism of their instrument and of its proper treatment. In consequence of this, abuses of all descriptions with this sublime instrument may daily be observed: waltzes, quadrilles, polkas, quick marches, and overtures are played on it, and in such a manner, too, which irresistibly impresses the looker-on with the idea that the performer must be a madman. Alas! if the churchwardens and the congregation at large could only know how much a cheap organist of this class spoils their organ, and how much cheaper it would have been had they engaged a good organist. *A violent drawing out of the stops* is likewise injurious, because it may easily cause some roller to break, or some slide to be thrown out, to say nothing of the disagreeable noise it produces. It is the duty of an organist to keep his instrument as much as possible in a state of cleanliness, and to remove speedily whatever he discovers to be injurious to the tone, or detrimental to any part of the organ. There is one part of the organ which often is literally maltreated by the organist, that is, the pedale. Some organists are accustomed, not only to spit upon the pedale, but also to load upon it all the mud they carry with them on their boots, so that the pedale frequently looks more like anything else than a part of this beautiful instrument. The consequence is, that the springs of iron or brass wire, which lie below the pedal-keys, frequently begin to rust and to break, and that some pedal-keys often stick fast, or act imperfectly, or sink down but half their depth, thus producing a howling of tones, or an imperfect, faint intonation. The organist will do well to take care that all the different parts of the organ are properly protected and closed up. It is particularly desirable that the pedale, as well as the stops, should be covered and protected in some way or other. A special attention must be bestowed on the bellows. The bellows-chamber must be carefully closed up, and the bellows-handle removed, so as to leave no possibility for curious persons to get at the bellows. The auxiliary weights upon the bellows must be locked up in some sort of box, since cases have happened, when organ-blowers, especially in hot weather, in order to render their task easier, have removed these weights altogether; the consequences, of course, would be very fatal to the organ. Finally, we give the organist the invariable rule, never to postpone too long the repairs which have become necessary with his organ, because faults that have only just arisen are easily and cheaply corrected, whilst when left unremedied they increase, and sometimes become irreparable.

CHAPTER III.

THE FAULTS ARISING IN AN ORGAN, TOGETHER WITH THEIR REMEDIES.

I.—*The howling, humming, or sounding of a pipe* is one of the commonest faults, and a very vexatious one too. This fault arises solely from the palate not closing perfectly, so that a portion of the wind is allowed to pass into the pipes of the registers which are just drawn, and makes them sound, although no key is pressed down. This imperfect closing of the palate may arise from various causes, sometimes from a mere trifle, so that it is often difficult to find out the cause. In these more difficult cases, the most judicious proceeding would be to ascertain, first, the *key* of the pipe which sounds, and then to examine, step by step, all the action-work connected with that key on to the palate. Thus, the *howling may arise from faults on the key-board.*—1. *Two keys may be bent,* so that either both, or one of them, sticks down. This may arise from excessive heat, by which a key might become crooked, and thus touch and molest its neighbour. In this case the organist must beware not to plane off the crooked key, in order to make it straight; because in this way he would greatly disfigure the key-board. The simplest way of straightening a crooked key is to wet it. But the bending of two keys may be occasioned by some small substance (sand, chalk, &c.) having got between them; in the same way a drop of tallow or wax falling from a burning candle may find its way between the keys, and prevent their acting. In these cases the fault is corrected simply by removing the interposing body.—2. *A key may lean too hard on the ledge,* traversing the key-board. This fault arises in damp or wet weather, when the trackers get shorter, and pull the keys more towards the interior of the organ. In this case it will be sufficient to turn the screw-socket, which connects the trackers with the screw-worm upon the key, somewhat to the left, when the key will receive a deeper position, and no longer stick.—3. *Some of the springs below the pedal-keys may be broken or displaced.* It would be wrong to use such a key any more before the fault has been corrected. A displaced spring must be placed right again, and a broken one replaced by a new one.—4. *A single key may stick down,* either because it has been swollen by damp, or because rust or dirt has gathered on the pegs upon which such key moves. This fault is easily remedied, either by removing the dirt, or by bending the peg or pegs a little sideways.—5. The howling may also be caused by a *careless coupling of the manuals.* The means to prevent this fault are simply care in coupling, and an occasional revision of the coupling-screws. *The cause of the howling of tones may also lie in the action-work.*—1. In back-choirs, or generally in key-boards which press upon *prickers,* it may happen that both the pricker and its sheath swell from damp. In this case the pricker must be taken out and filed off, or the hole in which it moves enlarged.—2. The trackers, too, may swell from damp, in consequence of which they would stick fast in their combs or in the cuts wherein they move, or they would move with difficulty. In this case the cuts must be enlarged by means of a file. —3. By a too violent playing upon the keys, a tracker may be thrown out from its cut (which very easily happens with long trackers), or the hook, the so-called S, by which the tracker is connected with the purse-wire, may be displaced. In this case it suffices to place the tracker or hook again in its former position.—4. The peg in which a roller moves may have got bent in some way or other, so that, in consequence, that roller would come in contact with another. Here the pegs must be taken out and put straight, or, if it should be inaccessible, the chisel must be applied to the roller or the roller-board, and a small piece taken off.—5. A roller may have become crooked. In this case it would require an organ-builder to put it straight, or to replace it by a new one.—*The howling of certain pipes may also arise from faults on the palates.* 1. A palate may be twisted between the pegs in which it moves; here a bending of the pegs sideways will remedy the fault. —2. The author has met with a case where such a peg had fallen out, in consequence of which the palate, though kept fast by its spring, was slightly removed from the groove, so that a howling was the consequence.—3. Sometimes sand or dust, or a piece of chalk may get between the palate and the grooves, and thus prevent the former from closing perfectly upon the latter. In this case the palate, together with its spring, must be taken out. For this purpose, an instrument called a *spring lever* is used. This instrument (see *Table* X, *fig.* 5) consists generally of strong iron or brass wire, long enough to reach into the great sound-board. Another sort of spring-lever consists of a long handle (see *fig.* 6), to which is fastened a strip of iron or brass plate, bent on both ends in form of a hook. This lever, which is better adapted for the purpose than the foregoing, is now applied to the palate-spring in the way we see on *fig.* 7, and the spring thus taken out; after this it will be easy to take out the palate also. The latter must now be cleaned, and that side of it which is covered with leather must be polished off by a piece of very smooth pumice-stone. After having cleaned the great sound-board, and polished off the edges of the groove (in the same way as the palate), the palate is placed again in its former position, as is likewise done with the spring. To be able to do this correctly, it will be necessary for the organist to examine closely the position of the spring, before he takes it out; then the bellows must be blown, and the organist must hear whether or not the howling has ceased. If not, he must see whether the respective tracker, or a hook on it, has been displaced. There are some organs where the palates are fastened to the upper part of the great sound-board by a strip of leather, and where, consequently, the palates cannot be taken out. If in this case something should have got upon the palate, nothing can be done but the spring taken out, and the surface of the palate carefully burnished or wiped.—4. Sometimes, particularly in damp churches, a palate unlooses itself from the strip of leather by which it is fastened to the great sound-board. Here the palate must be taken out, wiped, and provided with a new strip of leather; the place where the old strip was fastened to must be well rubbed with pumice-stone, so that every unevenness disappears; then the new strip must be varnished with hot glue, and the palate placed upon the opening of the groove, so as to cover it exactly; after which the the strip of leather is glued precisely over the same place where the old one was. After the lapse of a few hours, the glue will have become dry, and then the palate-spring is put in its proper place. Should the organist not be quite sure of his capability of undertaking a repair of this kind, it would of course be much better for him to apply to an organ-builder, rather than to do it badly himself, and to spoil something else, perhaps, besides.—5. A palate may have become crooked or warped, so as to be no longer capable of closing perfectly the corresponding groove. This fault can only be corrected by the organ-builder himself, either by rectifying the old palate, or replacing it by a new one. If the organ-builder should live at a distance, or if he should be unable to attend immediately, the organist, in order partially to remedy the howling of a pipe or pipes, must do as well as he can. The palate may be provided with a second spring, which must be very strong, so as to press the palate harder upon the opening of the groove. Or the palate might be covered with a second piece of leather, so as to make it fit better upon the opening of the groove. Or should none of these means prove efficient, the palate, by some other contrivance, must be so firmly pressed and kept upon the opening of the groove, as to shut up the latter altogether. Of course, in this case, no tone could be produced at all by the pressing down of the respective key, and in order to prevent further mischief, it is advisable to put under such key a piece of wood, to prevent its acting.—6. The palate-spring may lose its elastic power and become slack, so as to be no longer capable of pressing the palate sufficiently close upon the opening of the groove. This fault is indicated by an uncommonly slow rising of the key which has been pressed down, and the howling does not generally cease till the key has been raised by the hand. In this case the injured palate-spring must be taken out, and its elasticity increased by rubbing and bending its shanks, or the old spring must be supported by a second new one. Two springs, indeed, make the touch heavier, but this inconvenience is certainly the least of the two; still better would it be to remove the old spring altogether, and to replace it by a new one. Should the organist not be in the possession of a new spring, he might take out the palate-spring of some note which is seldom used, for instance the highest one on the manual, and place it under the palate of the howling pipe; an organist should always be provided with a few of these palate-springs.—7. By violent playing a palate may stick fast upon its peg, and thus become incapable of resuming its former position. Here the palate, together with its spring, must be taken out, and as the fault generally arises from the peg or the spring having become bent, both must be put straight.—8. In organs where strips or plates of brass are used instead of purses, the howling may arise from some tracker-wire having become rusty; a new wire must then be supplied.

II.—Another fault frequently occurring in organs is *the simultaneous sounding of another pipe with the one which is intended to sound.* Suppose the key e is played, then some other tone, for instance, d would be heard at the same time, though perhaps not so loud as e. This fault arises partly from an inaccurate construction of some parts of the organ, partly from the weather. If, contrary to rule, the upper-boards are merely nailed upon the wind-chest, and not screwed, it may happen that they may become somewhat loose, so as to leave a small space between the tables and the upper-boards; here it simply requires the upper-boards to be better fastened. Sometimes the upper-boards, or the wind-chests on the places where the slides move, are not properly planed off, so that a small interstice is left, through which a portion of the wind may pass into the wrong pipes; or the side-board of a groove may be cracked, and admit the wind into the adjoining groove. In this case either the major second below, or the major third above the tone, which properly ought to sound, will also be heard. For example, if the key g is pressed down, either f or b will sound too. Sometimes this co-sounding tone is not quite clear or distinct, owing to the smallness of the opening in the grooves, which prevents the requisite portion of wind from finding its way into the pipe. For the same reason this secondary tone is likewise often too flat. This fault appears most conspicuous when only two or three soft registers are drawn, for then these secondary or by-tones are quite insupportable. An organist will scarcely be able to remedy this fault; he would therefore do well to apply to an organ-builder, who could properly plane off the wind-chests and upper-boards, or repair the damaged grooves. But this fault may also arise from the pipes standing too close to each other, or from their lips being turned towards each other in such a way, that one pipe would also make its neighbour sound. In such cases it is no easy matter to correct the fault. Sometimes, however, it will suffice to turn the pipe a little sideways, or to provide it with a higher foot. Another cause of this fault is, that sometimes when one of the two adjoining slides is drawn out, it draws with it, partially at least, the other also, so that the latter is no longer capable of properly covering the openings of the grooves. To remedy this inconvenience, a peg might be put between the two slides, near the ends of the two respective wind-chests, or one of the two slides might be slightly planed off; a thing which had better be entrusted to the organ-builder.

III.—*The complete or partial cessation of the action of some parts of the organ* is another fault frequently existing in an organ, the consequence of which is, not exactly an actual disturbance during the performance, but a limitation of the means or resources of the organ.—1. In damp or wet weather, particularly in spring and autumn, it often occurs that *the stops are very difficult to be drawn.* In such cases the upper-boards are generally lying too close upon the slides; to use force to get the stops out would not remedy the matter, but more likely damage some part of the action-work, especially one of the roller-arms. It would be better slightly to undo the screws, by which the upper-boards are fastened upon the wind-chest. In drier weather these screws must of course be fastened again. This also should be done rather by an organ-builder than by the organist. It sometimes happens that the leather upon which the slide lies has unloosed itself. In this case the upper-board must be unscrewed, and the leather fastened on again, or replaced by a new one. In very hot weather the upper-boards frequently warp, and thereby produce the above-mentioned fault, which will, however, disappear by itself in more moderate weather. —2. A *cessation of the action* may also arise from some roller, or its peg, having become bent. This fault must be remedied by the organ-builder.—3. The *copulas* sometimes *are very difficult to be moved either way,* because the wood has swollen through damp. This fault ceases as soon as the weather becomes drier. We advise the organist always to undo the copulas immediately after they have been used, lest, when this fault arises, he should be obliged continually to use the copulas—a thing which might be very annoying to him; should the fault exist, the organist must dispense with the copulas altogether, and wait for better weather.—4. The *stops* sometimes draw out further than usual, or they come out altogether. The cause of this is simply the falling out of some peg or nail, which, when set right, will at once remedy the defect. —5. A *key* sometimes sticks down, without its corresponding pipe being heard to sound. This arises from some tracker having become detached, whereby the connection between the key and palate is destroyed. This is soon remedied when the tracker is placed right again, and its wire-sling somewhat narrowed, to prevent a repetition of the fault.—6. Sometimes, when the organ is supplied with wind, *a feeble humming*, or rather moaning, of the registers which are drawn, is heard. This is caused by the ledge which crosses the key-board pressing too hard upon the keys, whereby the palates are partly opened, but instantly shut again by the power of the palate-spring and of the wind. Such a partial opening and closing of the palates is repeated at very quick intervals, so that the feeble tones produced thereby assume a tremulous and moaning character. This fault is easily corrected by slightly removing the ledge from the keys.—7. The *keys* sometimes do not stand exactly on a level with each other, so that one stands a little higher, another a little lower, and so on. This fault arises from heat or wet, by which, the trackers, are very much influenced. To the remedy of this fault, which is effected by setting straight, or by screwing the key-board, a special chapter will be devoted in a subsequent part of this book. Every organist ought to understand this business, by which many irksome interruptions and inconveniences may be averted or remedied.

IV.—*Faults connected with the bellows.* 1. *The rattling or creaking of the bellows* during their action, which is particularly disturbing, when they are placed near or within the organ. The cause is, either that the iron pegs, which move in iron pans, and serve the bellows-pedal or handle as a sort of axle, are not quite in a straight position, or not properly oiled; on this something more will be said in a subsequent chapter. Or the cause may be great hardness of the leather, in which case a fresh and better supply of leather becomes necessary. A *jerking and noisy action of the bellows* arises from the sucker not being sufficiently large, or from its opening and closing too easily, so that every passage executed upon the organ is imitated by a continual opening and closing of the sucker, whereby a constant noise is occasioned. In general, such bellows do not hold sufficient wind to press the sucker firmly upon its frame. Hence, when, during the performance, such bellows lose some portion of their wind, a vacuum arises in the bellows, which the outward air immediately strives to fill up,—an endeavour which must necessarily succeed, as the air in the bellows is not strong enough to press the sucker upon its frame and to keep the opening properly shut. Now if, under such circumstances, certain peculiar passages are played on the organ, the bellows constantly move in jerks or shocks. This is one of the most disagreeable faults arising in an organ, and can only be corrected by a skilful organ-builder.—3. *The partial sinking of the bellows, and the subsequent complete stoppage of their action,* is a fault peculiar to those bellows, the suckers of which are too small, so that the quantity of wind passing through them is not sufficient to fill entirely the empty space in the bellows. Hence it happens that, after such a pair of bellows have been drawn up, they immediately and at once sink again a few inches, because the wind in them is not of sufficient volume to hold up the upper-board of the bellows. Here the sucker, that is, the hole in the bottom of the bellows, together with the valve covering it, must be enlarged.—4. *The uneven or unequal action of the bellows,* that is, one pair of bellows moving quicker than another, or several pairs of bellows rising simultaneously, is a fault which very frequently arises, particularly in old organs, where it can only partially be remedied, if at all. If the bellows are in a proper condition, and all the various wind-conductors hermetical, and still this fault is perceived, we may then suppose it to arise from the leather-work of one pair of bellows being more porous than that of another.—5. The *bellows fever,* that is, *the trembling or faultering of the wards,* is a great defect, which also imparts to the tone a tremulous unsteady character. It arises from one of the wards having altered its position, either by irregular blowing, or by swelling and getting heavier in wet weather, so that the wind passing through the ward into the great sound-board is no longer able to keep steady. Or it may arise from some ward having become too dry and light, so that the wind can easily move it to and fro, and prevent it from closing properly. Or the fault may be with the valve on the great sound-board, which sometimes, like a tremulando, beats up and down, thereby disturbing the free entrance of the wind into the great sound-board, and imparting this wavering of the wind to the tone also. Where this fault exists, it is difficult to tune the organ correctly, as the unsteadiness of tone deceives the ear. This fault can only be corrected by the organ-builder.

V.—*The escape of wind through some of the wind conductors* is a fault which manifests itself by a whizzing or rustling. It is often scarcely perceptible, and its cause is difficult to be discovered, especially in dark or inaccessible places. To discover the exact seat of this fault, it will be as well to place a handkerchief over the supposed place, when the whizzing will cease; or to approach the place with a candle, when the flame will flicker. The causes of this cardinal fault are various—1. *Damaged wood-work. Worm-holes* are remedied by being stopped or filled up with small wooden pegs dipped in hot glue. If there are many of them, strong paper should be glued over the eaten places, and the whole varnished with a pap of hot glue and bole; parchment being stronger, is preferable to paper; but then it must first lie in hot water for some time, after which it must be dried and covered over the injured parts by means of hot glue. To make it stick fast, it must be pressed on, and so kept for some time, with a rag dipped in hot water, or with a moderately hot iron; white dressed leather will likewise answer the purpose; the soft part of the leather in these cases is always varnished with glue. Yet all these remedies against the wood-worm are merely temporary, as it is utterly impossible to destroy this animal completely when it has once taken the field. A thorough removal of the damaged wood is the best and most lasting cure. *Cracks* in the wood, when but small, may be remedied in the same way as worm-holes; but when so large and long that a considerable portion of wind can escape, they must be filled out by closely fitting wooden ledges, which are glued into them, and the whole must then be covered over with paper, parchment, or leather. The *warping* of the wood-work of an organ, for instance, the wards, suckers, sucker-frames, &c., in consequence of which some wind is lost, must be remedied by the organ-builder himself, who will set the respective parts right, and render them again hermetical, or replace them by new ones. But sometimes, particularly in hot weather, the wards have only got loose, in which case they simply require to be more firmly screwed; or if the wards should not be made to cover, but to fit into the openings, then their edges must be covered with leather or paper, to make them fit perfectly; in damp or wet weather these coverings must of course be removed again. Sometimes *an escape of wind occurs just below the upper-boards*, especially in hot weather, when the latter have shrunk together. In this case the upper-boards must be screwed a little lower down, but not too low, or in damp weather the drawing of the stops would become very difficult. This means, however, is quite inefficient if the upper-boards are not accurately planed off, and the escape of wind is owing to this cause. In this case the bungling organ-builder will resort to making, in the lower side of the upper-boards, a number of small channels, through which the apparently superfluous wind is led away. Skilful and conscientious builders of course never have recourse to such bungling. But when this gross neglect is once indulged in, it requires a clever builder indeed, and much trouble also, satisfactorily to correct the fault; *Table III, fig.* 8, represents an upper-board thus spoiled.—2. The second cause of wind escaping is *damaged leather-work. a.—On wind-chests.* Sometimes a whizzing is heard just below the wind-chest, in consequence of the wind escaping on the side of a pull-down. Here the cause is, either that some purse has unloosed itself from the bottom-board, or that this purse has been damaged. In the first case the edges of the leather must be glued on again, and in order to increase the adhesiveness of the glue, the leather must be pressed and held on for a while by a moderately hot iron, or a piece of cloth dipped in hot water. Care must be taken, however, lest a drop of hot glue should fall upon and stick to some moveable part of the purse, whereby a friction would be caused, which might by degrees utterly destroy the purse. In the second case, the pull-down must be undone, both from its hook below and from its tracker, and the damaged leather must be torn off. After this, the old glue upon the bottom-board must be dissolved by the aid of a rag dipped in hot water, and all grease carefully scraped off. Now a piece of white dressed leather, tough but soft, and freed as much as possible from all chalky substances, is cut to the size of the old purse, laid over the hollow in the bottom-board, and by a fitting piece of wood stretched out in the form of a purse. The leather may also be stretched and formed upon a suitable globe. Then the purse-wire is likewise cleaned from all grease, and stitched through the middle of the purse in the same way as may be seen on all the other purses. After this, those places on the tube (in which the wire runs) which come in contact with the leather are varnished with hot glue, and pressed on till the glue has become dry. Now, by the aid of pliers (shaped like *fig.* 17, *Table X*) the purse-wire is placed again in its proper position. Finally, the edges of the entire purse are, on the soft part of the leather, varnished over with glue, fitted upon the bottom-board, and held on for some time in the way described above. Care must be taken that the purse is glued on to the bottom-board in such a way as to make the pull-down stand quite vertically in the hole of the bottom-board, else a friction will be caused, of which a howling of the pipes might be the consequence. For the same reason, care must be taken also lest some portion of glue should remain on any place where it ought not to be. After the glue has become dry, the connection between the pull-down, tracker, and palate is restored again, and the reparation thus completed; this, too, can only be done by the organ-builder.—*b. On the bellows, wind-conductors, &c. Cracks,* or *other openings* in the leather-work of the bellows must be glued over with white dressed leather, which ought, indeed, to be strong but not too hard. The proceeding is the same as described under V, 1. (for the covering of worm-holes). We have only to add, that in mending such damaged passages, the old leather must always be carefully removed before the new is glued on. Sometimes it happens that one of the horse-sinews, by which the various ribs of the bellows are kept together, breaks. In such a case the auxiliary weights upon the bellows must first be removed, and the sucker-frame disjoined. Then the bellows are drawn up, and the upper part is properly supported, so as to prevent its sinking down again. The interior of the bellows is now entered, the damaged horse-sinews taken out and replaced by new ones, in the way described in PART I, CHAPTER II. With smaller bellows such a repair can only be made from the outside of the bellows by taking off the entire trimming of leather. Repairs of this kind are likewise to be executed by the organ-builder only.

If the leather-work of some of the wind-conductors has become damaged in any way, it must be repaired in one of the ways already described.

VI.—*Faults incidental to the pipes.* 1. *The pipes are sometimes altogether silent.* This happens most frequently with the smaller ones, particularly with open pewter pipes, such as mixtures and similar registers. *An accumulation of dust* in the pipes is generally the cause of this fault, which can only be remedied by a thorough repair of the organ. Single pipes the organist may dust himself, using for the purpose a feather or a fine hair pencil, and taking care not to handle the pipes roughly, as they are very soon bent or broken; he must be particularly careful when he cleans the lips of the pipes, as the slightest pressure would cause a bruise, and easily spoil the whole pipe. To set a pipe right again which has been bent, the organist must either use an intonation-iron (see *Table X*, *fig.* 8), which is formed like the blade of a knife,—or a nail shaped like *fig.* 9, and smoothly polished on its crooked ends. In some cases a conical piece of wood, smoothly planed off, will do the like service. Now, if the lip is bent outwards, the broad side of the intonation-iron must be applied to it until it becomes straight again; but if the lip is bent inward, the bent end of that instrument must be put under the lip and gently drawn backwards and forwards, till the lip has resumed its proper position. In this, too, great care must be taken, lest the lip should get uneven or broken. During the act of correcting the intonation of a pipe, it must be made to sound so that it may be heard whether the tone produced is good and correct or not. By a repeated and rapid pressing down of the corresponding key, it may also be ascertained whether or not the pipe sounds or speaks quickly enough. *Sometimes the language of a pipe lies too high.* In this case, the pipe must be taken out, and the language pushed down, by the aid of an iron rod, with a smooth, even plane. *If the language should lie too deep* (a fault which arises from the language being either too heavy, so as to sink by its weight, or too weak, so as to be unable to support its weight), the iron rod must be put into the foot of the pipe, and the language be thus raised. Every pipe so mended must be tuned again accurately, according to the other pipes. If the language of a wood pipe should lie too high, so that too much wind passes out of the pipe, a fitting ledge might be glued upon the under-lip, so that the ledge may be of an equal height with the language; but if the latter should lie too deep, the ledge must be laid *upon* the language. A pipe also cannot sound when the glue by which its various parts are fastened together becomes dissolved, or when the under-lip has unloosed itself. These faults, which arise from excessive heat, are easily remedied by rejoining the dissevered parts. If the foot of a wood pipe be very badly worm-eaten, a partial or complete muteness of the pipe will be the consequence. Here the foot must be repaired, or replaced by a new one. In open wood pipes, it frequently happens that the little tuning board at the top of the pipe shrinks, by reason of excessive heat, and falls into the pipe, upon the language, so as to prevent the pipe from sounding. Here the tuning board must be replaced in its former position, and if it should no longer fit, a new one, either of wood or brass, would be required. With *stopped wood pipes* it sometimes happens that, in hot weather, the stopper shrinks and falls into the pipe. In this case, the stopper must be taken out, and thinly covered with leather, so as better to fit the aperture of the pipe. Care must be taken, lest the covering should be too thick, which would make it impossible to drive the stopper far enough down the pipe, to tune it properly. Paper, soft and wool-like, (not smooth,) will do, instead of leather. The same remedy may also be applied if this should happen with the stoppers of pewter or brass pipes. In wet weather the wedge of wooden flue-pipes often becomes narrowed, since the surrounding parts of the pipes are swollen by wet. In this case, the wedge must be widened. The reeds, being a very delicate kind of pipe, are often disturbed or injured by a trifle. Something may get between the tongue and beak, so as to prevent the former from vibrating, and the whole pipe from sounding. Sometimes a cobweb falls through the body of the pipe, upon the opening of the mouth-piece. Now, if the register containing such pipes be rarely used, or if, from dust or or dirt, the obstruction is increased, the pipe is quite incapable of speaking, until its various parts are one by one separated and cleaned. Sometimes the intonation of a pipe is prevented by the tongue lying too closely upon the beak. Here it becomes necessary to bend the tongue a little, which must, however, be done as carefully as possible, as, by unskilful management, the tone sometimes becomes uncertain,—at one time too sharp, at another too flat. This would be the inevitable consequence if the tongue were bent back on one side more than on the other. Another cause of this fault is, the little block, which keeps and presses the tongue on the beak, becoming loose, or even falling into the foot of the pipe. Here it is simply necessary to put the displaced parts again in their proper position. By a violent knocking or shaking near the organ, the tuning-crook may fall deeper into the foot of the pipe, so that the tongue, thus shortened, is no longer able to vibrate properly. 2. *The pipes sometimes do not speak or sound properly and correctly.* This may arise from the same causes as named under 1, as long as they do not exist to a very high degree. But there are other causes of a *feeble* intonation of some pipes; for example,—a cobweb may be drawn over the aperture of a pipe, or over its height; or a key may lie too deep, so that, in being pressed down, the palate does not open wide enough to admit such a quantity of wind into the pipe, as is requisite for a good, strong intonation. Here the key must be screwed higher. The height of some pipes is often too wide, in consequence of which, the tone is dim and faint. Pewter and brass pipes of this description may be corrected, by a strip of pewter or brass being soldered on to the upper-lip, so as to narrow the height. With wood pipes, a wooden ledge must be used, instead of a brass strip. Another cause of this fault, is the tongue being either too strong or too weak. In the former case, it must be thinned by a file or a pumice-stone; in the latter, it must be replaced by a new one. The tongue may also become displaced; or verdigris may gather on the place where the tongue touches the beak. In the first case, it will suffice to set the tongue right; in the second, the verdigris must be rubbed off by a leather, dipped in pumice-powder. 3. *Pipes sometimes produce a tremulous tone.* This happens most frequently with delicate registers, of a narrow measure, (*e. g.*, the gamba, salicet, &c.) Sometimes this fault is only perceived when the registers are used by themselves, and ceases as soon as they are combined with others. An organist would scarcely be able to remedy faults of this nature, because the pipes of such registers are so very difficult to handle; indeed, the slightest alteration in the position of the language, of the lip, or beard, is often sufficient to remedy a fault of this kind; but the difficulty is the finding out the seat of the evil,—a thing in which even organ-builders often only succeed after a number of experiments. In pewter pipes, with the usual diapason measure, the fault is easily corrected, by simply rectifying the language or the lip, according to the mode described under VI, 1. Wood pipes which produce a tremulous tone are remedied by a small wooden glut being driven into the wedge of the mouth. But the exact place for this glut can only be found out by repeated experiments, since the pipe must be sounded, and the quality of tone observed, whilst the glut is tried. In general, the tremulo ceases, if the glut is placed in the middle, or on the left or right end of the wedge. In all these corrections, it is a matter of course that the person who undertakes them, must always ascertain first, whether any sand, dust, &c., has got into the wedge, or the surrounding part of the pipe. Sometimes the tremulo in pewter or brass pipes arises from their being composed of too feeble material, or from their being bruised or bent in some way or other. In the former case, the sides of the pipes are not strong enough to counterbalance the power of wind in the pipe, and the sides, in consequence, often begin to vibrate; in the latter case, the column of air in the pipe assumes an irregular form, which irregularity is imparted also to the tone. Pipes which are too weak must be replaced by new ones, and those which are bruised or bent, must be rounded off again. In both cases, an organ-builder is required. Stopped pipes sometimes produce a tremulo, when the stopper does not sit firmly or steadily. 4. *Pipes sometimes sound the higher octave* of the tone which they ought to produce. This fault arises from the height being too narrow, or the wedge of the mouth too wide, or the supply of wind too great. In some few instances, pipes also sound the third or fifth of what they ought to sound. This fault is peculiar to delicate registers of a narrow measure, where it arises from the beards having altered their position, or from some alteration with the language or with the lips. To all these faulty phenomena, the quality of the outward air contributes a very large share. Now, if one of these delicate pipes, of a heavy intonation, receives but a little wind too much, it immediately over-blows itself, or sounds the octave. The organist must not be too hasty with the correction of these faults; because, very often, nature herself remedies them: besides, in almost all such cases, an organ-builder is required. The organist may attempt indeed a partial correction, by letting off that portion of wind which is superfluous through some other channel, in the mode before described. With pewter or brass pipes, the over-blowing is often corrected, simply by turning the upper or under lips a little; with wood pipes, by providing the height with a traverse beard. In *stopped pipes*, the over-blowing arises from dust or dirt having got into the wedge of the mouth; or from the stopper sitting too loosely; or from the pipe being cracked; or from the language laying too high. In all these cases, the proceeding is what we have already described. Sometimes the *over-blowing of reed-pipes* does not produce the octave of the proper tone, but the major or minor second above or below. The cause is commonly a wrong position, or an unequal thickness, of the tongue, or a looseness of the tuning-crook, or a wrong measure of the body of the pipe. In the first case, the tongue must be placed right again, so that its two ends are exactly the same distance from the beak. Should the pipe still over-blow itself, and produce a higher tone, the tongue, together with the mouth-piece, must be drawn out a little from the block; or the aperture of the pipe must be partly covered by a suitable little board (a sort of stopping); or the opening in the foot of the pipe must be narrowed a little, in the mode described under VI, 5. But should the pipe, in over-blowing, produce a lower tone, the tongue must be bent nearer to the beak; or the tongue, together with the mouth-piece, must be drawn out of the block a little; or the body of the pipe must be slightly shortened:—this latter operation can only be undertaken by the organ-builder. If the tongue should be too weak, it must be replaced by a new one: the same is to be said of an unsuitable or damaged tuning-crook. But the over-blowing of reed-pipes may also arise from the block having shrunk by heat, and by its sitting, therefore, too loosely in the foot. In this case, the block must be wound round by a strip of paper or leather, so as to gain a firmer stand; or the so-called block-screws must be applied. As the position and standing of the block have a great influence on the tone, special care must be taken that the block always sits firm and fast in the foot. Sometimes the mouth-piece is not accurately fitted into the block, so that some wind escapes through the crevice occasioned by this loose fitting. Here the mouth-piece must be wound round with a piece of paper or thin leather, so as to cause it to fit more perfectly. Organ-builders sometimes, when they do not succeed in remedying the over-blowing of a pipe, bore a hole into the foot, whereby they attain their object. Tuning-crooks, which sit but loosely, often fall, through some accident, deeper into the blocks, and thereby occasion an over-blowing:—this fault can only be corrected by the organ-builder, who shuts up the old holes in the block, and bores new, narrower ones, or introduces new, stronger tuning-crooks. Sometimes a single pipe of some reed-register is not correctly in tune, when some other register is drawn in with it. Here the fault arises from a disproportion in the supply of wind, since one register receives more than another; in consequence of which, the latter sounds flatter. The original fault here lies with the grooves, or their openings, which are disproportionally constructed, so as to contain either too much or too little wind. In tuning such a register, it becomes necessary, in order to equalize, at least partly, this disproportion, to draw, at the same time, all the other registers belonging to the same key-board. Sometimes, when there is one flue-register standing upon the wind-chest for the reed-registers of the pedale, (for instance, a violon sixteen feet,) and such a disproportion exists, it becomes necessary to draw, during the whole act of tuning the incorrect register, this flue-register also. 5. *Pipes sometimes sound too strong or too loud;* a fault which simply arises from the pipes being too plentifully supplied with wind. This is remedied by narrowing the opening in the foot of the faulty pipe by means of the so-called tuning-horn, (an instrument of which something more will be said in a subsequent chapter.) With wooden pipes, this narrowing is effected by a suitable little block of wood being driven into the foot, so as partly to close it up, and allow less wind to pass through,—a means which may likewise be applied to the wooden bodies of reed-pipes. In flue-pipes of pewter or brass, the wedge of the mouth is sometimes too wide, thereby causing too loud an intonation. Here it suffices to bend the under-lip a little nearer to the language, and to change the position of the upper-lip in a corresponding manner, (more towards the interior of the pipe.) Sometimes the tone of the reed-pipe is rattling and noisy, owing to the leather upon which the tongue beats having become too hard, or beaten through. In this case the leather must be rubbed with pumice-stone, to make it soft and woolly again, or it must be replaced by new leather. Sometimes the tongue itself is the cause of this rattling, noisy tone, since it stands too far from the beak, or is too feeble. In the first case it only requires the tongue to be bent more towards the back; in the second, a new tongue will be necessary.

6. *Pipes sometimes sound too slowly or too late,* that is, they do not produce the tone the instant the key is pressed down. This fault occurs most frequently with delicate registers of a narrow measure, and arises from the same causes as mentioned in the course of this chapter. If a slow or heavy intonation is not naturally peculiar to such pipes, the fault may sometimes be corrected by providing the pipes with side or traverse-beards, or by narrowing their height, or, in wood pipes, by glueing small strips of wood upon the upper-lip, under-lip, or language. In reed-pipes this fault arises from the tongue being too far from the beak, and is corrected in the way before described. 7. *Pipes sometimes produce,* besides their proper tone, a certain *humming, whizzing, or rattling noise.* This frequent fault sometimes arises from very trifling causes,—from the motion of a body or thing which is not at all connected with the pipes or with the organ; but the fault may also be with the pipe itself. Sometimes a pipe stands loosely in its place, so that it may be moved hither and thither by the force of the wind contained in it. The consequence is a sort of noise, ceasing as soon as the pipe is made to stand firmly, which is easily effected by various means. A front pipe sometimes leans too hard on the artificial foliage with which the case of the organ is ornamented, and thus produces a slight noise. Here a few chips must be taken off the ornaments. Mostly, however, this fault originates in the resonance of something near the organ, which is made to vibrate by the motion of the various parts of the organ. Windows, locks and bolts, iron or metallic trackers, loose doors, and other vibrating bodies, often produce a noise when the organ is played upon. This

simultaneous production of heterogeneous sounds very often influences the character of the tone of the organ to a very high degree. Securing the objects surrounding the organ in a firmer position is the only means which can be employed in order, partly at least, to remedy this vexatious fault.

Finally, we shall point out some *periodical repairs* which the organ from time to time requires:—1. *The setting straight and re-screwing of the key-board.* We have seen from the preceding, that from various causes, the keys of the manual or pedale sometimes assume a very uneven or unequal position with respect to each other, so that the one stands higher, the other lower, and so on. This is a very awkward matter, because the keys which stand too high often cause the sounding of a pipe, whilst those standing too low do not allow of a proper intonation,—and because it is very difficult to play on an uneven key-board, to say nothing of the unsightly appearance such a key-board presents. The organist must therefore be able to regulate the key-board, if it has become uneven, a proceeding which is briefly as follows:—First, that part of the organ-case which is called the music-desk is taken out. The ledge, however, crossing the key-board, must not be taken out too, as it is the test by which the organist can see whether he has screwed the keys too high. It is also necessary that the bellows should be blown during this transaction. The organist then begins to turn the screws, by which the key and tracker are connected, either to the right or to the left, according as he wants to give to the key either a higher or a lower position. Care must be taken not to screw the keys either too high, lest they press too hard on the crossing-ledge and produce, in consequence, a sounding of some of the pipes; or too low because it would prevent a good, clear, and prompt intonation. In this way the keys are gradually re-screwed, so as to represent a perfect level. Should a single key have become warped, it would be in vain to endeavour to make it exactly even with the others; the principal thing is, to give it the right distance from the crossing-ledge. With an organ of more than one manual, it becomes necessary, after having thus arranged the key-boards, to re-screw also the copula-screws. For this purpose the manuals must be coupled together, in order to determine the exact position of these screws. After having done all this, and whilst the manuals are yet coupled, the organist may execute on the key-board some quick chromatic passages, in order to see whether everything is right. Should one of the copula screws turn too easily, it must be replaced by a new one. To re-screw the pedale in this way will scarcely ever become necessary. 2. *The oiling of the axles, pegs, &c. connected with the bellows.*—This becomes from time to time necessary, in order to prevent the disagreeable noise which otherwise would arise while the bellows are blown. For this purpose it is first necessary to take out the pegs by which the pusher and bellows-handle, or pedal, are connected, as likewise the handle itself. Now these pegs, together with the holes in which they move, as likewise the handle, together with the axles and pans, round which and in which it moves, must be freed from all grease, and a mixture of fine olive-oil and scum-soap, or neat's foot oil must be applied. The same must be done with all the other pegs and their holes, and with all places where wood comes in contact with wood and causes a friction. 3. The tuning of the organ, of which we shall treat in the following chapter, is not a thing indeed which we can reasonably expect the organist to be perfectly expert in; yet he should know so much, at least, as to be able to correct single pipes which have got out of tune, and to rectify other little faults connected therewith and arising therefrom.

CHAPTER IV.

THE INTONATION, TEMPERING, AND TUNING OF AN ORGAN.

For several reasons, which seem quite obvious, it is most desirable that the organist should be, at least, so far familiar with these things, as not to be obliged to apply to an organ-builder at every trifling fault which may arise.

Before the tuning (either partial or complete) of an organ can commence, a good, that is, *easy* and *quick intonation*, or speaking, of all the pipes must be effected, and every pipe must be made to produce a tone which, in character, quality, or colour, is equal to that of all the other pipes belonging to the same register. After this, the *tempering* of the organ can begin. Now, as a treatise on the mathematical proportion of the intervals to each other, with regard to their vibrations, &c., would be too long for this book, we here again advert to the admirable work of Professor Töpfer on this subject (the complete title of which we have already given at the end of Part I), from which all those who are desirous of doing so may gather the most minute information on all these things. Equally adapted for this purpose are also Scheibler's writings on the "Musical and Physical Mensuration of Tone," by whose method the most perfect purity and correctness of all the intervals may be obtained. We therefore only give some general hints.

Since in our times the unequal temperament, on account of its many disadvantages, has been universally abandoned (though not in England), we only treat of the *equal temperament*. The equal temperament effects an equalisation between the various intervals, so that with respect to the mathematical proportion of their vibrations there is no difference between thirds and thirds, fifths and fifths, and so on. Thus, the fifth c to g would, in a given time, make *proportionally* the same number of vibrations as the fifth c sharp to g sharp; or the fourth d to g the same number as the fourth a to d. The consequence of this is, that the inversion of an interval makes the same agreeable or disagreeable, consonant or dissonant impression on the ear, as the original interval (for instance, g to c the same as c to g). To effect this, it becomes necessary:—

1. To tune major fifths lower, fourths higher;
2. Major thirds higher, minor sixths lower;
3. Minor thirds lower, major sixths higher

than they ought to be according to their mathematical proportions. *Unisons* and *octaves* must be tuned perfectly pure, that is, so that no vibrations or beats are heard. The simplest and best adapted intervals, in order to find out the even temperament, are fifths and fourths. To add octaves is not exactly necessary, but it serves to determine whether or not the proper proportion between the fourth and fifth has been discovered. According to the method we are going to describe, thirds and sixths are obvious.

As every organ ought to be tuned the proper pitch (that is, the orchestra pitch), it would be well to commence the work by tuning some note of the diapason, for instance c, according to a correctly tuned instrument, a clarionet or hautboy for example. Now the proceeding is continued thus:—

1. To $\underline{c}$ is tuned its upper fifth $\underline{g}$, and then its higher octave $\underline{\underline{c}}$ (or the fourth of $\underline{g}$).
2. To $\underline{g}$ is tuned its lower fourth $\underline{d}$, and then its lower octave g (or the lower fifth of $\underline{d}$).
3. To $\underline{d}$ is tuned its upper fifth $\underline{a}$, and then its higher octave $\underline{\underline{d}}$ (or the fourth of $\underline{a}$).
4. To $\underline{a}$ is tuned its lower fourth $\underline{e}$, and then its lower octave a (or the lower fifth of $\underline{e}$).
5. To $\underline{e}$ is tuned its upper fifth $\underline{b}$, and then its higher octave $\underline{\underline{e}}$ (or the fourth of $\underline{b}$).
6. To $\underline{b}$ is tuned its lower fourth $\underline{f}$ sharp, and then its lower octave b (or the lower fifth of $\underline{f}$ sharp.
7. To $\underline{f}$ sharp is tuned its lower fourth $\underline{c}$ sharp, and then its lower octave f sharp (or the lower fifth of $\underline{c}$ sharp).
8. To $\underline{c}$ sharp is tuned its upper fifth $\underline{g}$ sharp, and then its octave $\underline{\underline{c}}$ sharp (or the fourth of $\underline{g}$ sharp).
9. To $\underline{g}$ sharp is tuned its lower fourth $\underline{d}$ sharp, and then its lower octave g sharp (or the lower fifth of $\underline{d}$ sharp).
10. To $\underline{d}$ sharp or $\underline{e}$ flat is tuned its fifth $\underline{b}$ flat, and then its octave $\underline{e}$ flat (or the fourth of $\underline{b}$ flat).
11. To $\underline{b}$ flat is tuned its lower fourth $\underline{f}$, and then its lower octave b flat (or the lower fifth of $\underline{f}$).

The tempering may be considered successful, if this last $\underline{f}$ sounds to the first tone $\underline{c}$ (of which it forms the fourth) a little too high. But the tempering may be commenced with any other tone, for instance with $\underline{a}$, and then the last tone would be $\underline{\underline{d}}$, which must sound rather high (or sharp) in proportion to $\underline{a}$. Should the first experiment prove unsuccessful, it must be repeated until the right proportion is found out. The first requisites for such a business are a good ear, caution, and patience. Before the tuning of the octaves (that is, of all the rest of the tones) commences, the organ must be left alone for about a week, and every day the condition of the temperament must be examined into, when it will be found that there are always some slight corrections yet necessary. On a pure, correct tempering of the organ solely depends the whole tuning. After the diapason has thus been tempered throughout, the actual tuning of the organ can commence. For this purpose several instruments are required, which we shall enumerate and describe.

1. *An Anemometer, or machine for weighing the wind.* This machine we have already described in PART II, CHAPTER II. It is not required for the tuning of single pipes, but only for a thorough tuning of the organ, when it is the means by which the force of wind requisite for the organ is ascertained. If an old organ should require a thorough tuning, and the former force of wind have been lost, it will in most cases be easy to find out what degree of wind the organ requires; because every organ-builder, after having finished an organ, writes on the great sound-board or somewhere else the number of degrees of wind which he has given to it. But if this should have been forgotten by the organ-builder, it would not be so easy to discover the former degree of wind. In this case every pair of bellows must be examined separately, since the organist tries all kinds of registerings, or combinations of registers, and executes with them the most varied passages. If the wind which a single pair of bellows produces is too weak, the tone of the organ is faint and feeble; whilst, if the wind is too strong, the pipes over-blow. Now, after having found a pair of bellows which produce exactly the right power of wind, the degree of that wind must be ascertained by means of the anemometer, and in the way described in PART II. After this the anemometer is applied to all the other pairs of bellows, in order to see whether they all produce the same degree of wind as the first pair. Should this not be the case, auxiliary weights must be applied in the way described in former chapters, until a perfect uniformity is effected. Whilst a pair of bellows are being blown and the anemometer applied to them, should *the water in the latter machine change its position,* then the strength of the bellows-springs must be either increased or diminished. If the water sinks whilst the bellows sink too, it indicates that the bellows-spring, at the moment when the bellows begin to sink, has not strength enough to act properly upon them. Hence the spring must be made tighter, by shortening the rope to which it is fastened. But if the water rises whilst the bellows sink, the spring must be made slacker.

2. *Three tuning-funnels* (or horns) *of different size, for enlarging or narrowing the aperture of open pewter or brass pipes.* It would be desirable to have, besides these three, a very small funnel for the mixture pipes, with a rather long handle. The funnels are generally of brass, or of smooth and hard wood, in which latter case it would be well if they were covered over with brass or iron-plate. The common, simple tuning-funnels are the shape of *fig.* 10 on *Table X.* Preferable to these are tin ones, that have a handle and a double funnel, of which the one is used for the expansion, the other for the contraction of the pipes (see *fig.* 11). The proceeding in tuning is this :—*If a pipe is too flat,* the funnel is put into the aperture of the pipe, and the latter then widened by a soft pressure upon the former. This must be repeated till the pipe tunes correctly; but not too long a time and in too short intervals, because it would make the pipe warm, and thereby expand it. If the pipe is too high, its aperture must be narrowed a little by the hollow one of the two funnels. If it should not be possible to tune a pipe low enough in this way, it must be replaced by a new and longer one, or the old one must be lengthened by soldering on a strip of brass or pewter. If a pewter pipe is so very low that the widening with the funnel proves inefficient, in order to make it tune high enough, a piece of the pipe at its aperture must be cut out entirely, or cut off on the two sides only, and bent down; this can only be done by the organ-builder. But there might be other causes why the pipe tunes so very low. The language or the lips may be in a wrong position, or the beards in a wrong direction, or perhaps the pipe does not stand properly in its hole, or the wedge of the mouth is partly stopped by dust or sand, or the like. Even the key may be the cause of a pipe tuning too flat, for instance, if it stands too low, so that the palate cannot open sufficiently wide, to let the requisite portion of wind pass. All this must be investigated before the widening of the pipe is commenced. With some open pewter pipes the tuning-funnels cannot be used, because they have tuning plates soldered on to their aperture, which must be handled like the tuning-boards, of which we shall speak presently. Open wood pipes have at their aperture a small board, called a *tuning-board,* which is driven in between those two sides of the pipe which stand opposite each other. But as these boards are too much dependent

on the weather, and as they influence the tuning to a high degree, it is better to use, instead of them, square plates of pewter or brass (*tuning-plates*). The position of these plates affects the pitch of the tone, so that, if they are turned more towards the interior of the pipe, so as to narrow the aperture, the tone will become lower; whilst when turned more to the outside of the pipe, so as to widen the aperture, the tone will become higher. The mixtures, and registers with several ranks, are tuned by means of the tuning-funnel. But as every key here contains several pipes, all of which have one hole in common, there must be some contrivance by which the other pipes can be stopped while the one is tuned. This is done by what is called (3) *the mob* (see *Table X*, *fig.* 12). The mob is a sort of brush, consisting of threads of wool or silk, which are glued on to a thin handle of wood or wire. For the sake of convenience, the handle has a sort of ring or sling at the end. The brushes of the mobs must be either thicker or thinner, and the handles either shorter or longer, according to the length of the mixture pipes. Now, if a pipe is to be tuned, the mobs must be dropped into all the other pipes of the same rank, so as to prevent their sounding or whizzing. In this way the other pipes of that rank are likewise tuned. Before the tuning of any rank can commence, the intonation of every single pipe must first be examined into, and, if necessary, corrected.

4. For the tuning of *stopped pipes, one or two wooden hammers and a mallet* are required. *Fig.* 13 on *Table X* represents a hammer of this kind, and *fig.* 14 a mallet. With stopped pipes the pitch of the tone depends on the lower or higher position of the stoppers. To make the pipe sound lower, the stopper must be drawn upwards, so as to enlarge the body of the pipe; whilst, to make it sound higher, the stopper must be driven downwards by means of the hammer, so as to shorten the body of the pipe. Should the stopper sit too fast to be drawn up, a gentle knocking about the handle of the stopper, and a little helping afterwards, will effect this; but then the pipe, which will have become warm during this transaction, must be left to cool before the stopper is put in again. In driving a stopper down, the blows must not be dealt exactly upon the middle of the handle, but on the edges round. It is advisable to lay a small board upon the handle (which must, however, be a little larger than the

handle itself), and deal the blows upon that. Sometimes there is no possibility of driving the stopper far enough into the pipe, either because the body of the pipe is too narrow, or because the leather round the stopper has swollen by damp or wet. In the former case the leather may be exchanged for a new and thinner one; in the latter, the stopper must be dried before the fire or in the sun. Or sometimes the stopper sits fast upon the edge of the pipe, instead of fitting into the aperture, so that there is no possibility of getting it lower down. In this case a small strip must be cut off from the edge of the pipe; but this can only be done by the organ-builder. If there should be a difficulty in getting out the stopper of a wood pipe, the pipe must be taken out, and the edges of the pipe gently knocked, whilst the stopper is drawn by the handle. Sometimes stoppers have, instead of a handle, a hole in the middle, into which the mob is placed, in order to get the stopper out. In driving in or taking out the stopper, care must be taken lest it should sit in an oblique position, as this would easily crack the pipe. With very large stopped pipes, which are sometimes difficult to get at, the mob is used, a rod being put through the ring of the mob, which thus serves as a sort of lever, by which the stopper is drawn up. If the stoppers of such large pipes should be provided with a handle, the best way of getting them upwards would be to knock with a hammer about the edges of the handle. With moderately large pipes, the stoppers of which have no handle, the following means may be applied:—a piece of lead or tin, &c. may be put into the pipe (through the height), and moved here and there, so as to beat upon the stopper and to force it gradually out. A temporary expedient for tuning stopped wood pipes, the stoppers of which cannot be moved lower, would be to put a traversing beard into their height. A peculiar mode of stopping, worthy of being generally adopted, has been invented by the organ-builder Vogel, in Frankenstein. He gives the stoppers no handles, but lays a little board over the aperture of the pipe; through this board goes a screw, which sticks fast in the stopper. By means of this screw the stopper can easily be moved up and down, without there being any danger of cracking the pipe.

5. *For the tuning of reed pipes* the following instruments are necessary:—1. A *plier*, shaped like *fig.* 15 on *Table X*, for drawing

up the tuning-crooks. 2. A *chisel* (*fig.* 16), to assist in taking out the block of the mouth-piece. As in hot weather the blocks often sit too loosely in the foot of the pipe, they are provided with little screws of brass wire, the upper part of which is bent in the form of a ring (see *fig.* 14). These screws go through the upper part of the foot, and keep the block fast. Thus, if the block is to be taken out, this screw must first be undone. If this cannot be effected by the hand, the plier must be used, or a *screw-key* (see *fig.* 14), which consists of a thick worm of wire, bent in the form of a hook, and provided with a handle. The principal instrument used in tuning reed-pipes is the plier. If the tone is required to be lower, the tuning crook must be drawn upwards by the aid of the plier; if it is to become higher, the tuning-crook must be driven lower down. Thus the position of the tuning-crook determines in reed-pipes the tone, in the same way as the position of the stopper in flue-pipes. By driving the tuning-crook deeper down, that portion of the tongue which is allowed to vibrate is *shortened*, in consequence of which the vibration becomes quicker and the tone higher; whilst the reverse is the consequence if the tuning-crook is pulled higher up. The tuning of reed-pipes must be done as carefully as possible. The tuning-crook must not unnecessarily be moved or bent, or violently pulled out, because the hole in which it sits gets very easily widened, so that a loose sitting of the tuning-crook and a frequent untuning of the pipe would be the consequence. In general, all violent turning and moving about, during the act of tuning reed-pipes, must be scrupulously avoided, as the slightest shaking or knocking would influence the tone. A slight pushing of the body of reed-pipes often makes them get out of tune. Sometimes the tone of a reed-pipe appears uncertain and unsteady, now a little lower and then a little higher. This arises either from an irregular blowing, or from a wrong construction or position of some part of the lip, &c. The key of such a pipe must be struck down several times, in order to see whether there is really any fault or not. But this repeated striking or pressing down of the key must, especially with the lower pipes, be done in short intervals, and not too quickly after each other; because the tongue, when once in motion, is some time before it is at rest again—a condition at which it always must have first arrived, in order to determine whether or not there is any real fault. The tuning-crook is very often the cause of a reed-pipe tuning wrong; the slightest alteration in its position will cause a lower or a higher tone. The reed-pipes are more frequently subject to get out of tune than the flue-pipes, and as their tone is of a peculiar clearness, the fault becomes the more perceptible. In small churches it frequently happens, especially in very cold weather, that by the respiration of the great number of persons assembled, the temperature in the church is so suddenly changed, that the reed-registers get frightfully out of tune; the service being over for a while, all is right again. Thus, in organs built for very small churches, reed-registers should be but sparingly used. It is moreover advisable always to tune the reed-registers (if they require tuning at all) shortly before the beginning of divine service. At every considerable change of the weather, from cold to hot, or from dry to wet, and *vice versa,* the organ (especially the reed-pipes) is always somewhat deranged. The best time for tuning reed-pipes, as regards the weather, is when it is getting warmer, because then all the tones being too flat, it simply requires the tuning-crooks to be driven down a little, in order to restore a correct tuning. Some organ-builders provide reed-pipes with a tuning-screw instead of a tuning-crook, so that if the tone is required to be higher, the screw must be turned to the right, and *vice versa.* There are many who prefer these screws to crooks.

General rules for tuning the organ.—In tuning one pipe, another which has been already tuned must be made to sound at the same time, and then the tuning must be continued, and the two pipes must sound together, until the slightest difference between them has disappeared. The fittest register for being tuned first, and for thus serving as a standard for the other registers, is the open diapason of pewter, because wood, stopped, and reed-pipes are more subjected to an uncertainty or variableness of intonation. The diapason being finished, the other flue-registers are tuned, and in the order in which they follow according to their size. The reed-registers are tuned last.

The art of tuning an organ perfectly correct being so very difficult, and often proving so very unsatisfactory, a contrivance has been invented, by which the correct tuning which has been effected with *one* portion of the pipes may be easily transferred to another portion. This contrivance, called the *tuning-pipes,* consists in the following. A small wind-chest, upon which the twelve diatonic and chromatic pipes of the octave from $\underline{c}$ to $\underline{\underline{c}}$ are standing, is properly provided with palates. These palates are either connected with the action-work of the organ, and thereby opened, or they are opened by the pressure of a small weight, which is hung upon the tracker of that tone which is to be tuned. A small channel, put into a certain hole of the wind-chest, leads the wind to these tuning-pipes. All the wind-chests ought to be provided with a hole for this purpose. In the absence of special tuning-pipes, the twelve pipes of an octave of some correct register (for example, of the octave four feet, or of the diapason) may be used instead. Organ-builder Müller, in Breslau, always tunes the whole of the organ according to *one such octave.* Now, after the diapason has been completely tempered and tuned, the turn comes to that register which stands immediately behind it (we will suppose the gamba), of which the octave from $\underline{c}$ to $\underline{\underline{c}}$ is tuned accurately according to the same octave of the diapason. Now the diapason is pushed in, and the rest of the gamba is tuned, in octaves, according to the octave already tuned. But it would be quite as well to tune each separate tone of the gamba according to the corresponding tone of the diapason. This is the way in which all the other registers are gradually tuned, viz., according to the diapason.

It sometimes happens that a tone tunes quite correctly with its higher or lower octave of the same register, but not with the same tone of another register which has already been tuned. This arises, either from an imperfect intonation, or speaking, of that pipe, or from the pipe receiving too much or too little wind. Hence it often becomes necessary to compare three or four registers with each other, in order to obtain, at least, a tolerably correct tuning. To insure greater correctness, it will be necessary to compare the pipes of the register to be tuned in two different ways—first, among themselves (without any other register being drawn); and second, with the diapason. *In tuning mixture-registers,* the following method will be found the best. The octave from C to c, that is, from C on the second ledger line below the bass clef, to c in the second space of the bass clef, is tuned according to the fifteenth, or super-octave two feet. The octave from c to $\underline{c}$, that is, from c in the second space of the bass clef to the lowest treble c, is tuned according to the octave four feet, and the two upper octaves according to the diapason. The reason why these very small pipes in the upper region of the mixture are to be tuned according to such large pipes as those of the diapason is this, if two very small pipes are made to sound together, the vibrations are so quick, as to puzzle the ear, and to render a correct tuning very difficult; whilst, if a larger pipe sounds together with a small one, the vibrations of the former are so very slow, distinct, and intelligible, that those of the same pipe are very easily distinguished from them, so that there is no great difficulty in finding out whether the small pipe sounds too high or too low. *The intervals of secondary registers* (thirds and fifths), *as likewise of those mixture-registers which have thirds or fifths among their ranks, are not tempered; but are tuned perfectly pure, according to their mathematical proportions.* In larger organs it frequently happens that two mixture-registers (for instance, the cymbal and mixture) stand together upon one upper-board. Now, in tuning these two, it would be better to draw them both at once, and to tune them together, as they often, when tuned separately, do not tune together afterwards, though they are both perfectly in tune with the registers according to which they have been tuned; this arises from their receiving an unequal quantity of wind. The pedale and the other manuals (if there should be more than one) are tuned according to the diapason of the great organ. The best method seems to me to be that of Mr. Müller, viz., to tune first in all the registers (whether they belong to the manual or the pedale), the octave from $\underline{c}$ to $\underline{\underline{c}}$, according to the same octave of the diapason.

During the act of tuning, all the doors and other entrances to the organ must be properly opened. The person who does it must not be too thickly dressed, and must take care not to get into a perspiration, as the warmth produced thereby would influence the tuning. It would be well were he not to remain too long in one place, because the pipes near him would gradually get warm and untuned, but tune, first a register of the great organ, and then one of the swell organ, or of the pedale, and so on. To ascertain whether a pipe is too flat or too sharp, it is simply required to approach the aperture or the height of the pipe with the hand, whereby the tone will become lower. Thus, if in doing so, the tuning of the pipe gets worse, it shows that the pipe is too flat. The getting worse is manifested by the quicker succession of the shocks or beats in the vibration. Pewter and brass pipes ought not to be touched during the act of tuning, and if this has been done (in taking them out), they must be allowed to get cold again, before they are tuned. Pipes already tuned must on no account be touched, because they would immediately get out of tune again. Of pipes which are out of tune to an extraordinary degree, we may suppose that there is some fault with the action-work, or some other part of the organ, by which this great incorrectness is caused, and we must therefore investigate the matter first, before we proceed with the tuning. The same must be done as regards the standing or position of the pipe, for if the pipe does not stand firm or accurately in its hole, all attempts at tuning must prove fruitless.

PART VII.

THE BUILDING, REPAIR, AND EXAMINATION OF AN ORGAN.

CHAPTER I.

WHAT IS TO BE PRINCIPALLY REGARDED IN THE BUILDING AND ERECTION OF AN ORGAN.

1. *The choice of a clever and careful organ-builder.*—By not exercising sufficient judgment in this respect, the money of the congregation is often expended and wasted in a most wretched manner, the organ-builder, either on account of his ignorance or of his avarice, producing a work which does not in the least answer the high promises he has made. There are, among organ-builders, a great number of bunglers and charlatans, who often manage very cleverly to obtain the highest testimonials from persons who actually understand little or nothing of the matter (for instance, from clergymen, churchwardens, &c.) Of beginners in this art, before they are intrusted with the building of an organ, it must first be ascertained whether they have studied under good masters of an established reputation, or have visited their workshops. Work that is *too cheap* is generally bad; and there is always a well-founded reason for distrust, when an organ-builder makes an offer quite out of the common way. A worthy man, whose character is sufficiently known, should never be bargained with too much, or he will be obliged to make up for a scanty remuneration, by *using materials less efficient* than he would have used, had his reasonable demands been agreed to. Extreme economy in this matter will always prove ill-timed, and will be more than balanced by the expense afterwards incurred, through the frequent repairs which become necessary in a cheaply constructed organ.

2. *The place where the organ is to be erected.*—The good or bad qualities of an organ, as well as the general effect of the instrument, greatly depend on this important point. In general, the organ is placed in that part of the church which stands opposite the altar and the pulpit, and, moreover, on the western side of the church. This is done partly for the sake of symmetry, and partly in order to make it possible for the organist to observe the movements of the minister, a thing which is particularly necessary in Roman Catholic churches. Should it, however, be absolutely necessary to place the organ in some other part of the church, it must be done so as at least to avert the bad influences of sunbeams, rain, snow, draught, &c., things which have been sufficiently spoken of in the preceding part of this book. In building the choir of a church (that part in which the organ generally stands), care must be taken to build it sufficiently wide and lofty, lest the organ-builder, being obliged to make the organ-case as narrow as possible, huddle the pipes together in a manner which may prove detrimental in many respects. In an organ thus arranged, repairs are very awkward to be executed, as the narrow spaces between the various parts do not allow of a convenient access. If the choir of a church is not sufficiently high or deep, the organ-builder must have recourse to the so-called *mitering* (or mytering) *of the pipes*, a mode which has many disadvantages. The mitering consists in this:—If a pipe, for want of room, cannot be placed upright, it is provided with a *myter* or knee, that is, the upper part of the pipe is cut off and joined to the lower one in a right or obtuse angle (see *Table VI, fig.* 20). Sometimes pipes require even a repeated mitering (see *fig.* 19). This mitering greatly influences the intonation and tone of a pipe, because the wind is disturbed, and even broken by the angle. This disadvantage is somewhat mitigated by the miter being joined at an *obtuse* angle. Pipes of a narrow measure and a delicate intonation do not admit of being mitered, whilst reed-pipes admit of it almost without detriment to the tone or intonation. The space between the upper part of the organ-case and the ceiling of the church must not be too large, because the tone, by having to go a long way through the pipe up to the ceiling, and from thence into the nave of the church,

becomes faint and indistinct. Where this space is necessarily very large, because the choir of the church is excessively high, it becomes necessary to provide a sort of auxiliary ceiling at a small distance above the organ-case, by which means the tone is thrown into the body of the church. This auxiliary ceiling must, of course, stand higher on the front of the organ and lower on the back. But it would be quite as bad if the organ were so placed that the pipes reached almost or entirely up to the ceiling of the church, because then there would be no room for the tone to spread out.

Should the choir of a church be absolutely too low for the erection of an organ, then it must either be laid deeper, or the ceiling of the church must be raised. This latter remedy has again its disadvantages, as the tone would be partly swallowed up by the cavity in the ceiling, which would be caused thereby. In order partly to avoid this disadvantage, that cavity or deepening in the ceiling should receive a curved form, so as to diminish and vanish gradually towards the front of the organ. Sufficient room must also be upon the choir of the church for a quire and an orchestra, as likewise for a convenient seat for the organist. Behind the organ, too, there must be sufficient space, so that the person employed in repairing may easily go round the organ. Besides this, it would be wrong to place the back of an organ immediately against the wall, as damp and wet would soon find their way through the latter into the organ; besides which, the ringing of bells (which are sometimes placed in the neighbourhood of the organ) often shakes the wall, and with it other parts of the organ—a thing which frequently happens in small old churches which are feebly built. But if the choir of the church is so small, as to render it necessary to place the organ against the wall, the latter must, at least, be properly wainscoted. Further, the organ ought to be placed so, that it may be easily seen from the body of the church, and that the organist may receive sufficient light for reading his music. But, for reasons already explained, the organ must not be exposed too much to light either, especially to sunbeams. The windows near the organ must be so constructed as to open—a thing which becomes absolutely necessary when the church or the organ-choir is to be cleaned.

Neither is it a matter of indifference where the bellows should be placed. They ought to be as near the organ as possible, and, indeed, immediately behind it, when possible, because then the wind passes, undisturbed and unweakened by a long passage, immediately into the pipes, to say nothing of the saving of expense on account of all the wind-conductors requiring a smaller size. In such a case, however, the bellows must be separated from the organ by a wooden partition, to prevent the tone from being thrown backwards, instead of forwards, into the church. Here the idea might be suggested of placing the bellows within the organ. Such an arrangement, however, is not advisable, because the inner space of the organ, which ought to be free, in order to serve as a resonance for the tone, would then be filled up with things that would absorb the sound to a very great extent. Besides, the interior of the organ would then be so crowded with all sorts of objects, as to make it very difficult and awkward to get at the various parts in case of a repair becoming necessary, not to mention the noise often produced by the blowing of the bellows, being then sooner heard by the congregation. Owing to want of room, the bellows are often placed within the spire, or in the loft of the church, or in a separate apartment. In such-like arrangements it is absolutely necessary that the canals (especially the great sound-board), by reason of their great length, should be made of particularly good and sound wood, as their destruction, especially by the wood-worm, would cause the ruin of the whole work. Besides, the wood used for these parts must be varnished with glue and bole, and the knags and knots must be taken out and closed up with pegs, or covered over with leather or parchment. These canals must, further, be sufficiently wide, to supply the organ plentifully with wind, without which the tone would assume a moaning and jerking character. Where they are mitered, or carried in an oblique direction, they must be particularly wide. To prevent the jerking of the tone, Wilke recommends pyramidical canals, beginning wide with the principal canal and narrowing towards the great sound-board. This has been done already, and to great advantage too, with two organs, at Perleburg and Salzwedel. The narrowing amounts to one inch for every seven feet. When the bellows lie very distant from the organ, they require also auxiliary weights.

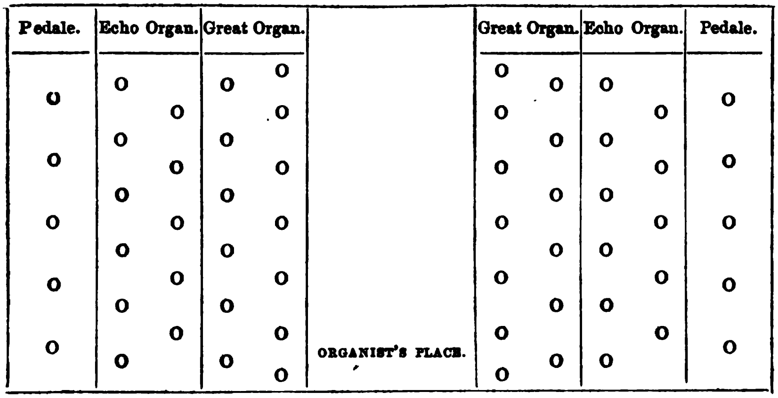
3. *The size and number of the registers.*—Before making an

arrangement of the organ with regard to this point, it is necessary to ascertain whether the church has much resonance or not, and whether or not the tone spreads easily. This may be done by calling loudly and by walking quickly in various parts of the church: where the calls and steps are loudly and distinctly re-echoed there is much resonance. The easy spreading of tone and the existence of much resonance may also be judged from the effect the church-music produces, when heard from the opposite side of the church. Now, where there is much resonance and an easy spreading of the tone, fewer organ-registers are required than where this is not the case. But it must not be forgotten that when the church is crowded the tone becomes much more faint and feeble. This is the case in a still higher degree, if the church has little resonance. We therefore give the advice, always to allow the organ a few registers more than are actually required by the character of the church, especially in cases where the congregation has large funds at its disposal. But more than fifteen or sixteen registers should never be placed upon one wind-chest. Where the pecuniary means of a congregation are limited, fewer, but stronger and more effective registers, must be chosen, and the wind-chests might be constructed somewhat larger than would actually be required, in the hope that, if better times should come, the organ might be augmented by some new register. The exact number of registers required for a certain church cannot be positively, but only approximately stated, as this greatly depends on the stronger or weaker singing of a congregation, and on the strength of the registers chosen. For a parish of from 200 to 300 inhabitants, an organ with from eight to ten registers may suffice; for 400 to 500 inhabitants, an organ of twelve to sixteen registers; for 1000 to 2000 inhabitants, an organ of twenty-four to thirty registers.

4. *The plan and arrangement of the whole work.*—Under this head we mention:—1. *The number of the bellows, and their position.* Want of room sometimes renders it impossible to construct the bellows (for a large organ especially) sufficiently large. In such a case, a greater number of smaller bellows, though not less than eight feet long and four feet wide, laid above each other, must be substituted; or, if circumstances allow, the bellows may be made wider and shorter. The number and size of the bellows required

for an organ cannot be positively stated, as this depends on various circumstances. We direct our readers, for this purpose, to the last part of the present work, where, from the numerous descriptions of various organs there given, he may form a correct idea as to the number of bellows required for an organ of a certain size. The bellows must be so placed as to be easily accessible on all sides, and the wind-trunk of each pair of bellows must be provided with some sort of opening, through which it may be possible to get to the wards and other valves, in case of a repair being necessary. 2. *The arrangement of the wind-chests and of the great sound-board.*—Both these parts must be so placed as to be easily accessible from all sides. This is particularly necessary with the great sound-board, as it becomes so very frequently necessary to get at the palate. The bottom, or supporter, whereupon the wind-chests rest, must be particularly strong and firm. If want of space should make it impossible to place the wind-chests *above* each other, they may then be placed *behind* each other, or two manuals may act upon one wind-chest. 3. *The position of the roller-boards* depends on that of the wind-chests, on which it depends also whether roller-boards or roller-frames are to be used. To prevent their warping, the roller-boards must be composed of very dry wood, and be encircled with a frame. The rollers must be so placed as to prevent any friction or twisting with regard to themselves or the roller-board. If rollers of so great a length should be required that they are necessarily in danger of warping, it would be better to divide them into two parts, and to connect these parts in the usual way. Instead of the wooden plugs, in which the rollers move, some organ-builders use brass pegs, which are a little broader on their front end. These brass pegs, occupying less space than the wooden ones, render it possible to place the rollers nearer together, so that the whole roller-board can be constructed smaller, and a deal of room be saved. In placing the roller-boards, and indeed the whole action-work in general, care must be taken by the person who does it to avoid all unnecessary noise or violent shifting. Experience shows that it is not advisable to compose too many of the moveable organ parts (such as rollers, traces, hand-draw stops, &c.) *of iron*, but rather of good, hard wood, because these parts, when composed of iron, often produce an insupportable noise as soon as they are made to act. 4. *The number and position of the key-boards and copulas.*—The number of manuals depends on the number and size of the registers. Small organs, with from six to twelve registers, have generally only one manual; larger ones, with from sixteen to thirty or thirty-six registers, have two manuals; and the largest ones, with from forty to sixty, or more registers, have three manuals, or even four. Every church organ, however small it may be, ought to have two manuals at least, not only for the sake of variety (especially as regards forte and piano) in the performance, and in consideration that many organ pieces are expressly written for performance upon two manuals, but also in order that, if one of the manuals becomes unfit for use, from some great fault having arisen, the organist may have at least one other manual at his disposal. For similar reasons, every organ should also be provided with a pedale. As to the *compass of the manual,* it ought to be observed as a strict rule, never to give the manual a less extent than four octaves (from C to $\overline{\overline{\overline{c}}}$); all bungling with short, broken, or incomplete octaves ought for ever to cease. Sometimes the manual goes up to $\overline{\overline{\overline{f}}}$. This is not indeed necessary, as in real compositions for the organ this high region is never touched (arrangements of other compositions for the organ are of course excepted); but it has the advantage, that the organist, when introducing to his congregation some unknown hymn or choral, may play the melody in octaves, so as to make it very prominent. *The pedale* ought to have an extent of at least *two* octaves, from C to $\overline{c}$. But as the note $\underline{d}$ frequently happens in older compositions for the organ, especially in those of Seb. Bach, it would be better to give the $\underline{d}$ in addition. Some pedals go even up to $\overline{f}$. Further, the *key-board and keys must be of the exact scale;* that is, they must neither be too wide nor too narrow, because, in both cases, an inconvenient playing would be the consequence; neither must they be too short, because this would render the touch heavier. The fall of each key should never be more than $\frac{3}{8}$ of an inch. The touch must not be too hard or heavy; the copulas may or may not be used. The touch also must be equally hard or heavy throughout the whole of the manual. The pedal-keys must not be too broad or wide, or lay too far from each other, because in both cases the extent of the pedale would become too great and the playing of octaves difficult. The extent of a pedale from C to $\underline{d}$ ought to be about four feet (Prussian measure); the length of the keys two feet, and their breadth 1¼ inch at most. The pedal-keys must not be too narrow or small; nor must they be placed too closely together; because in the former case the player would very easily miss his key, and in the latter he would constantly incur the danger of catching two keys at once. The deepest fall that ought to be allowed to pedal-keys is *one* inch, otherwise the alternate use of the top and heel of the foot would become very difficult. It would be well to give the under-keys of the pedale, on the place the heel treads upon when the top of the foot is on the upper-key, a slight elevation in the form of a tubor, so as to render the change between heel and top easier. This latter advantage is said to result also from a new invention by Sheibe, in Sohra, who calls his invention an "*auxiliary pedal.*" The famous organ-builder Walker, in Ludwigsburg, kingdom of Würtemberg, has begun to provide very large organs with two pedales, the one for a soft, the other for a strong performance. The manual must be so placed that the player can easily reach it; for, if it were too far off, the player would have to extend his arms so much, that he would very soon become fatigued. This would also be the case if the manual were placed too high. The most convenient position for the manual is this: if the organist place his hands upon the keys, the two halves of his arm should form an obtuse angle. In organs with two manuals, the lower one must have this latter position; whilst in organs with three manuals, the lower one must be a little nearer to the organist, so that the upper one can be reached conveniently. It would be very desirable, indeed, if the seat for the organist were so constructed that it could be screwed up or down, according to necessity. The *copulas* must be so constructed that they can be easily moved. The best contrivance is, where the copulas are managed, either by a sort of stop drawn out by the hand, like the register-stops, or by a sort of pedal, acted upon by the foot. In organs with more than one manual, such a contrivance would hardly be practicable. Finally, it would be better to have the copulas on the left hand side, so that, whilst the left hand manages them, the right hand may continue to play.

5. *The arrangement of the stops.*—The stops must be arranged or placed, not only symmetrically, but also conveniently for the player. The farther they are from the player, the more inconvenient it becomes for him to handle them. Thus it is better to arrange them so as to form vertical rows, not horizontal ones. The principal registers should be put apart or separate in some way or other from the secondary and mixture stops, so as to render it easy for the organist to transit from piano to forte, and *vice versa*, as quickly as possible. In organs with several manuals, the registers belonging to one manual ought to be placed together, and separated from those of another manual, perhaps in this way:—



Sometimes the stops of the great organ are all on the right side, and those of the echo organ and of the pedale all on the left. The handles or buttons of the stops are of hard wood, commonly of pear-tree, and provided with labels of white china, upon which the names of the registers are engraved or written with indelible colour. On the labels of mixture-stops, not only the *number*, but also the *size of ranks* ought to be stated, because, for instance, a mixture $1\frac{1}{3}$, 1 and $1\frac{1}{2}$ foot, sounds very different from a mixture 1, $\frac{2}{3}$ and $\frac{1}{2}$ foot. It is not advisable to use strips of paper, and to write the names upon them, because the paper gets soiled or lost, or the names erased; and it frequently happens that wrong names get substituted for the lost ones, and that a new organist, who knew nothing of the organ before, is quite puzzled at finding either wrong names or none at all; besides, the strips of paper confuse the eye of the organist, especially when he is in haste, as he then easily forgets whether these strips belong to the stops above or below them:

6. *The materials of which the various part of an organ are to be composed.—a. The organ-case and its decoration.* The finest and noblest style of architecture for an organ-case is the Gothic. It is generally composed of sound fir or pine-wood, free from knots. The boards must be at least 1½ inch thick. The artificial foliage with which the case is decorated is commonly made of linden-wood, as this is one of the softest and most yielding sorts of wood. The decoration in general of the organ-case ought to be in conformity with that of the altar and pulpit. The finest and most suitable colours for the organ-case, with which the highly polished front pipes form a most lovely contrast, are dark brown, or green, or grey marbled. The simplest, and therefore most frequent, varnish is white, with an appropriate gilding. The most unsuitable colour is blue. On the construction of bellows, canals, stopping-valves, palates, wind-chests, slides, grooves, &c., all that is necessary has been said in former chapters. *b. The wire and screw work.*—For all the various sorts of hooks, as likewise for the palate-pegs and tuning-crooks, strong and faultless brass wire must be used; for all valve-springs, drawn brass wire, which does not run in splinters. All screw-worms ought to be made of brass wire, and to be provided with a socket or box (female screw) of strong head or sole leather. For the purse and valve-wires, either brass or iron wire is used. If purses are used instead of brass strips, the leather of which they are composed must be soft but strong, and freed from all chalky substances. All pegs or pins, by which the moveable parts of the organ are connected, must be strong (they may be of iron), and provided with a screw-worm and socket (or box), to prevent their falling out. The roller-pegs likewise must be of iron, or of English iron wire. The upper-boards must not be nailed on, but must be provided with strong iron screws, which must be smeared with tallow, or some other kind of fat, in order to prevent their contracting rust. The same precaution must be taken with all other iron screws. The worms of all screws must be sufficiently deep, to make the screws durable.—*c. The pipes* are either of pewter, brass, or wood. The pure English pewter, or grain

pewter, is the handsomest and most durable, though the most expensive material. The front pipes are almost always composed of this material. But where there are sufficient funds, all the diapasons, principals, octaves, thirds, fifths, mixtures, &c., as likewise all delicate registers of a narrow scale (such as the gamba, salicet, &c.), and the bodies of all eight feet reed-registers, ought to be composed of good pewter. A pipe of good pewter produces a stronger, fuller, and firmer tone than a brass pipe, especially if the pewter has first been hammered. Besides, pewter pipes are seldom, if ever, attacked by saltpetre or sugar of lead—a doom which sooner or later invariably awaits all brass pipes. Finally, pewter pipes are not so easily bent, bruised, or otherwise damaged, especially during the act of tuning. To save expense, a great portion of the pipes are often composed of brass. This is nothing but a mixture or composition of lead and tin, which is more or less valuable, according as the tin or lead predominates. A composition in which lead predominates is objectionable, not only because the pipes composed of such brass produce an effeminate tone, but also because they are sooner destroyed by saltpetre or sugar of lead, and because such pipes are too heavy to bear their own weight, so that sooner or later they bend and break. Bad material is very easy to distinguish from pure pewter, by its conspicuously blue (lead-like) colour. Hence, deceitful organ-builders, in order to hide or obliterate this conspicuous sign, mix the composition with marcasite or mundic, which renders the whole somewhat harder and better, and imparts to it a whiter appearance. But there is another criterion to discover good and bad brass. In bending together a quantity of good, pure pewter, a sort of crackling or prickling is heard, which is not at all perceived in doing this with bad brass. Good brass consists either of fifteen parts pewter and one part lead, or of fourteen parts pewter and two parts lead. An inferior composition may consist of ⅔ pewter and ⅓ lead, or ⅗ pewter and ⅖ lead. Brass is best adapted for registers with conical bodies, which are to produce a soft tone (such as the gemshorn, flaut allemande, &c.), as likewise for those fifths which are not to have a very shrill, penetrating tone (for instance, the nasat and gemshorn fifth), but particularly for stopped registers. The bodies of soft reed-registers, too, such as the bassoon, shalm, &c., are often made of brass. On their apertures both brass and pewter pipes must be made a little weaker (thinner), so that little force may be required in applying the tuning-horn. The feet of brass and pewter pipes ought to be particularly strong, as they have to bear the whole weight of the pipes. This is especially requisite with brass pipes, as the specific weight of lead and tin bears a proportion like 11 to 6. The language, too, must be sufficiently strong and well worked, so as to prevent their sinking down in the middle by the pressure of their own weight. Other pipes are composed of wood, and experience has proved that pipes of good wood are better, and last longer, than pipes of bad metal. The best sorts of wood for this purpose are oak, maple, beech, and pear-tree, not only because they are never damaged by the wood-worm (provided they are properly dried and lyed), but because they admit of a fine polish, &c., and because they produce, on account of their hardness, a very good tone. Most of the stopped registers, as likewise all stoppers, are made of oak. Fir and pine are sometimes used for large open registers, such as the diapason, violon, gamba sixteen feet, and other eight feet basses, as likewise for the bodies of thirty-two, sixteen, and eight feet reed-registers. Wilke proposes pine also for soft flutes and other stopped registers. The under lip, which on wooden flue-pipes is always composed of some very hard sort of wood, must not be glued, but screwed on; or if the former is done, it would be well to glue a piece of linen between the under lip and the adjoining part of the pipe, as this would greatly serve to increase the durability of the whole. The inside of pipes which are composed of fir or pine must be varnished with glue and bole, whereby the pipe will receive more smoothness and compactness, and be protected from the wood-worm. Another remedy against the wood-worm is a decoction of walnut leaves with alum, with which the pipes are besmeared when the mass is very hot. Yet for the sake of improving the tone, Töpfer recommends to varnish all pipes, whether of wood or pewter, with some sort of lac. All wood used for the construction of organ-pipes must be properly dry, and free from all knots and knags, for reasons which have already been stated. It ought to lie for some years out of doors, so as to get properly lyed (washed in lye), and freed from all vegetable constituents. After this it must be kept in some dry but airy place for some years more, before it can be used. If this proceeding is not adopted, the wood parts of an organ will inevitably be destroyed by the wood-worm. The feet of reed-pipes, as likewise the blocks, must be of hard and faultless oak. The levers by which the tongues are kept upon the beaks are generally made of white beech. The beaks are sometimes made of wood, but, in general, for eight feet reed-pipes, brass, and for sixteen feet or thirty-two feet, metal is used. Tongues and crooks must be of brass. Iron crooks are altogether objectionable, as they very soon rust and break. In order to save expense, the lowest octave (and sometimes two octaves) of a register is often composed of wood, whilst the upper octaves are of pewter or brass. In making his estimate, the organ-builder must clearly and minutely state all this, especially which registers he is going to make of wood, and which of pewter or brass; in what proportion he is to take tin and lead for his brass; whether any of the pewter or brass registers are to receive any wood pipes in the lower part, and at what tone these wood pipes are to cease; finally, what kind of wood he is going to use for the wood pipes, as well as for the various other parts of the organ. Without such a detailed and distinct estimate, a congregation or private person may be most unmercifully cheated.

CHAPTER II.

THE ARRANGEMENT OF REGISTERS IN GENERAL, AND THE TEMPERAMENT AND PITCH OF THE ORGAN.

1. With regard to the *number of registers* which an organ should have, we have already said that it mostly depends on the size of the church. Here we shall chiefly dwell on the due proportion between the manual and pedal-registers. The manual being the most important one of the key-boards, requires the largest number of registers. The general proportion is one pedal-register to one or two manual-registers. Circumstances, however, which cannot be taken into account before-hand, often necessitate a deviation from this rule. At all events it is advisable to provide an organ with the pedal-registers rather too numerous than too few.

2. As to the *progression of the registers*, an organ can only be considered as a harmonious whole, when it contains all the requisite 32, 16, 10⅔, 8, 5⅓, 4, 2⅔, 2, 1⅓, and 1 foot registers. This regular progression will always be disturbed whenever one of these numbers is wanting, or one of them is too powerful or too weak. No organ can contain one only of the three kinds of registers (principal, secondary, and mixture-registers); but all three kinds ought to be contained in every organ. In the manual the eight feet, and in the pedale the sixteen feet measure must be predominant. Yet an organ which contained in the manual only eight feet, and in the pedale only sixteen feet, would be a very poor instrument. In order to render the tone distinct, penetrating and round, the pedal requires some eight feet in addition (and perhaps some four feet and some fifths too), whilst the manual requires some four and two feet.

3. With regard to the *character of the registers*, it is an established rule, that no organ should contain either stopped registers only, or open ones only; because, in the former case, the tone of the whole organ would be too faint and indistinct, in the latter, too cutting and shrill. Consequences similarly faulty would result, if an organ were provided with flue-registers or with reed-registers exclusively. As we have already said, all kinds are requisite, in order to complete, strengthen, and soften each other. Thus, every manual ought to contain:—1. An open diapason, with all the other registers depending on it in size and measure, viz., the octave, fifth, third, super-octave, and mixture. 2. A number of stopped registers. 3. A number of open flue-registers, of a scale different from that of the diapason, including some registers with conical bodies. 4. A number of reed-registers. The pedale, too, requires one or more registers of these four kinds. In his estimate, the organ-builder must clearly state the number, name, and size of the pedal-registers, as well as of the manual-registers; and of the mixtures in particular he must state the number and size of ranks, as likewise the tone at which the repetition of a mixture is to commence.

4. On the scale of an organ, which may be large or small, we have said all that is necessary in former chapters. The same remark applies also to the intonation of an organ, concerning which

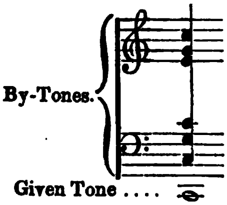
we will only repeat that it ought to be as quick, distinct, fine, powerful, and steady as possible. The *pitch* of an organ ought to be in accordance with the prevailing orchestra pitch, and all the old nonsense of tuning an organ half a tone too low or too high ought to be for ever discarded. The same must be said of the unequal temperament, which ought never to be tolerated, under any pretence whatever.

Here follows, in the original German, a most minute *estimate* of an organ, made out and duly signed by the brothers Müller, sen. and jun., of Breslau. The organ was designed for some church in Cosel (Silesia), and the estimate was submitted to the Prussian authorities, who had it examined by competent judges. But the price of material and of labour being so much lower in Germany than in England, the particulars of this estimate can be of no use to English organ-builders or organists. We therefore only give the result. According to this estimate, the brothers Müller engage themselves to build an organ with two manuals, pedale, and 20 registers (viz., 11 registers for the great organ: diapason, bourdon 16 feet, portunal flute 8 feet, double flute 8 feet, double rohr-flute 4 feet, octave 4 feet, fifth 5⅓ feet, fifth 2⅔ feet, super-octave 2 feet, mixture 5 ranks, clarionet 8 feet;—5 registers for the swell organ: principal 4 feet, salicional 8 feet, major flute 8 feet, traverse flute 4 feet, violini 2 feet;—4 registers for the pedale: violon 16 feet, sub-bass 16 feet, trombone 16 feet, violon 8 feet) for 1753 Prussian dollars, or £263 sterling. The estimate was approved of in every point, and the sum demanded was granted accordingly. An instrument of this kind would cost in England about thrice that sum.

CHAPTER III.

ON THE ARRANGEMENT OR COMPOSITION OF REGISTERS IN PARTICULAR.

We have already said that eight feet ought to form the basis of the manual-registers, and sixteen feet that of the pedal-registers. Now it is evident, from the way in which some of the secondary and mixture-registers are composed, that, if all the registers of an organ are drawn, and a single key is pressed down, the whole major chord of that tone or key is heard. The natural by-tones (or harmonics), of which we spoke in a former chapter, give us an unmistakeable hint of the order or proportion in which we must redouble the intervals of a chord, and, in consequence, what arrangement or composition of registers would be the most natural and efficient. From the example on by-tones there given, it follows, *that the redoubling of the tonic is most frequent, that of the fifth less so, and that of the third the least frequent.* This hint, naturally suggesting itself, it will be best to follow, and in order to show it more clearly, we present our former example once more, and *give to every by-tone a particular register*, thus:—



	feet.	
Sedecima	1	These three forming, as it were, a mixture of three ranks.
Fifth	$1\frac{1}{3}$	
Third	$1\frac{3}{5}$	
Super-octave	2	
Fifth	$2\frac{2}{3}$	
Octave	4	
Diapason	8	

Here we see at once the correct arrangement of an organ with seven registers in the manual, and at the same time the plan, according to which the various kinds of registers must be proportioned, with respect to their size. But, of course, this plan requires modification in other respects, for we have already remarked that the registers, such as 1, $1\frac{1}{3}$, and $1\frac{3}{5}$ foot, must always be used cautiously and sparingly, because in too great numbers they deprive the tone of the organ of its dignity and gravity, without adding much to its fullness and solidity. Besides, as this plan contains only registers of diapason measure, it follows, from what we have said in the preceding chapter, that it is not complete, because the three other kinds of registers are altogether wanting. Every manual requires, in addition to its diapason, some four, five, six, seven, or eight feet (according to the size of the organ), and other eight feet partly belonging to the flue-registers and partly to the reed. These eight feet, again, require an adequate number of four feet, which, however, must never be equal to, much less exceed, the number of eight feet, because the latter should always predominate. In general, *one* four feet is reckoned for two or three eight feet. Sometimes, when a manual contains two or three sixteen feet and six or eight eight feet, that manual may contain even four four feet. These four feet, again, must likewise present some variety as regards their character, that is, besides the octave four feet, which always belongs to the diapason, there must be one or two stopped, or conical four feet. However, organs with nine or ten registers in the manual ought to contain, in the latter, also a bourdon sixteen feet; whilst those with twelve and more registers ought to have two sixteen feet (such as the quintaton, rohr-flute, or double diapason) in the manual. In organs with three manuals the second manual ought to have likewise a sixteen feet flue-register (such as the bourdon), which, however, must be of a narrower scale than the sixteen feet in the great organ. There are some large organs where even the weakest manual is provided with a sixteen feet. A sixteen feet is a very valuable addition to a manual, as it imparts to the tone an extraordinary gravity and dignity. A sixteen feet diapason is more particularly adapted for large organs; and for smaller ones, a bourdon or a quintatone sixteen feet.

As to the *reed-registers*, organs with two manuals have generally but one reed-register in the great organ; but in larger organs, every manual is generally provided with one reed-register,—a stronger one (such as the trumpet) for the great organ, and weaker ones (such as the hautboy or clarionet) for the choir and swell organ. Sometimes the great organ of a large organ contains both a sixteen feet and an eight feet reed-register; or sometimes a sixteen feet without an eight foot. This latter arrangement is only admissible where the manual contains also a sixteen feet flue-register and the pedale at least two thirty-two feet. The sixteen feet reed-registers are purposely made of a weaker intonation, so as not to overpower the eight feet. Reed-registers of four feet in the manual are very seldom made use of now, as they are so very shrill and so delicate and sensitive in their intonation. In the pedale of large organs, however, the clarion four feet produces a very good effect. Besides this, there belong to the diapason in the manual a fifth $2\frac{2}{3}$ feet, and perhaps a gems-horn fifth, especially if there are some one or two sixteen feet in the manual. If the manual contains a diapason sixteen feet, then the fifth 5⅓ feet is indispensable. The diapason, further, requires a super-octave two feet, and the sixteen feet diapason a super-octave four feet.

With respect to the *secondary and mixture registers* the following is to be observed. The organ should never be overloaded with such registers, and the ranks should never be too small, that the disadvantageous repetition of the mixtures may be avoided An organ with less than twelve registers should not have any mixture at all, and for an organ with twelve registers a mixture of three ranks will be sufficient. In large organs the great organ often contains both a mixture and a cymbal, the latter with more ranks than the former. The cornetto being so well adapted for making a choral melody very prominent, every organ, whether large or small, ought to contain it. On the peculiar character of each mixture and secondary register, as well as on their judicious application, we have said all that is necessary in former chapters, and especially in the list of registers.

As regards the pedale, the same rules apply. We have already said that one pedal-register will be sufficient for two or three manual-registers, and that the sixteen feet are to form the basis of all pedal-registers. The proportion between the sixteen feet and eight feet in the pedale is the same as that between the eight feet and four feet in the manual. The fifth 5⅓ feet cannot be used where there are but a few (four or six) registers in the pedale, because it would be too prominent, especially if it is open and cylindrical. In pedales with more registers, some organ-builders introduce (after Vogler's system) a fifth 10⅔ feet, in order to produce by this register, in combination with the sixteen feet, a thirty-two feet tone. Sometimes the pedale contains a counter-diapason thirty-two feet tone, a fifth 10⅔ feet tone, and a double-diapason sixteen feet. The smallest register in the pedale can only be a four feet, because smaller registers, such as two and one foot, would greatly impair the gravity and dignity of the pedale tone. Besides, it would be quite superfluous to put such small registers in the pedale, as the manual-registers of this size may be coupled to the pedale. For the same reason, the super-octave four feet may likewise be omitted in the pedale and replaced by some larger register. If the pedale is to have a great number of registers, and among these a mixture, then the highest rank of this latter register must be at least four feet (or two feet, if the organ is but moderately large). Small and middle-sized organs ought to be always provided with a pedal-copula. In order to explain our principle still better, we now give some arrangements (descriptions or plans, as they may be called) of organs of various sizes.

I.—Arrangement of an Organ with 8 Registers.

MANUAL.	
1. Principal	4 feet
2. Octave	2 feet
3. Major flute	8 feet tone
4. Major flute	4 feet tone
5. Salicet	8 feet
6. Gemshorn	8 feet
PEDALE.	
7. Sub-bass	16 feet tone
8. Violon	8 feet
A pedal-copula.	

The author, though no admirer of four feet diapasons (or principals) as the basis of an organ, could not refrain from giving at least *one* such arrangement, because there are a large number of organs without a diapason eight feet. But then the rest of the plan is generally quite different from the one here given. The builders of such organs, forgetting that the eight feet ought to be dominant, that, even without a diapason eight feet, the eight feet system ought to be the basis of the arrangement, and that this principal four feet is nothing but the octave of the eight feet system,—have provided these organs with a number of small paltry registers, such as two and one foot, but hardly with any eight feet at all. The effect of such a system is wretched, as may be expected. If, for the principal, we were to substitute in our arrangement the diapason, then we should be obliged to omit the gemshorn. Some might think a sixteen feet violon or quintatön would be better for the pedale than the violon eight feet, because by the pedal-copula the eight feet of the manual may also be gained for the pedale. This, indeed, is true; but it often happens that the salicet and gemshorn cannot be carried through the whole manual, especially through the lower octaves, on account of the church being too low, so that these registers must be completed by some stopped register (the quintatön, for example). In such a case an effective eight feet in the pedale becomes very desirable. But if it were possible to give the pedale an eight feet diapason, instead of an eight feet violon, the latter might be replaced by a sixteen feet violon.

II.—ARRANGEMENT OF AN ORGAN WITH 16 REGISTERS.

GREAT ORGAN.

1.	Diapason	8 feet
2.	Octave	4 feet
3.	Fifth	2⅔ feet
4.	Super-octave	2 feet
5.	Mixture, 4 ranks—	2, 1⅓, 1 and ½ foot
6.	Portunal	8 feet
7.	Bourdon	16 feet tone
8.	Major flute	8 feet tone
9.	Double flute	4 feet tone

CHOIR ORGAN.

10.	Salicet or gamba	8 feet
11.	Traverse flute	4 feet
12.	Flaut amabile	8 feet tone

Here might also be a Cornetto with three ranks.

PEDALE.

13.	Violon	16 feet
14.	Violon	8 feet
15.	Sub-bass	16 feet tone
16.	Trombone	16 feet
	or Bourdon	16 feet

To which must be added a manual and a pedal-copula. The choir organ must be of a narrower scale than the great organ. It would also be as well to provide the great organ with some penetrating flue-register, such as the gamba.

III.—ARRANGEMENT OF AN ORGAN WITH 31 REGISTERS.

GREAT ORGAN.

		feet.
1.	Diapason	8
2.	Octave	4
3.	Fifth	2⅔
4.	Super-octave	2
5.	Mixture of 5 ranks	2, 1⅓, 1, ⅔, ½
6.	Cornetto of 3 ranks	2⅔, 2, 1⅗
7.	Portunal or gamba	8
8.	Rohr flute	8
9.	Rohr flute	4
10.	Bourdon	16
11.	Trumpet	8

CHOIR ORGAN.

		feet.
1.	Diapason	8
2.	Octave	4
3.	Nasat	2⅔
4.	Super-octave	2
5.	Mixture of 4 ranks	2, 1⅓, 1, ½
6.	Salicet	8
7.	Gemshorn	8
8.	Major flute	8
9.	Major flute	4

Instead of the gemshorn, a hautboy or clarionet eight feet might be introduced.

PEDALE.

		feet.
1.	Diapason	16
2.	Octave	8
3.	Fifth	5⅓
4.	Fifth	10⅔
5.	Super-octave	4
6.	Violon	16
7.	Violon or double flute	8
8.	Sub-bass	16
9.	Counter-diapason	32
10.	Trombone	16
11.	Trumpet	8

A manual and a pedal-copula. Instead of No. 5 in the great organ, a Sharp with four ranks, and instead of No. 5 in the choir organ with four ranks, three ranks might suffice, so as to avoid an excessive noise.

IV.—ARRANGEMENT OF AN ORGAN WITH 46 REGISTERS.

GREAT ORGAN.

Wide Scale.	feet.
1. Diapason	8
2. Octave	4
3. Fifth	$2\frac{2}{3}$
4. Super-octave	2
5. Cornetto, 4 ranks	4, $2\frac{2}{3}$, 2, $1\frac{3}{5}$
6. Mixture, 5 ranks	2, $1\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{2}$
7. Gamba or Portunal	8
8. Hohl flute	8
9. Bourdon	16
10. Quintatön	16
11. Major flute	8
12. Double rohr flute	4
13. Trumpet	8

SWELL ORGAN.

Medium Scale.	
1. Diapason	8
2. Octave	4
3. Fifth	$2\frac{2}{3}$
4. Super-octave	2
5. Mixture, 4 ranks	2, $1\frac{1}{3}$, 1, $\frac{1}{2}$
6. Salicet	8
7. Gemshorn	8
8. Double flute	8
9. Gemshorn	4
10. Clarionet	8

CHOIR ORGAN.

Narrow Scale.	feet.
1. Diapason	8
2. Octave	4
3. Nasat	$2\frac{2}{3}$
4. Super-octave	2
5. Mixture, 3 ranks	2, $1\frac{1}{3}$, 1
6. Gamba	8
7. Flaut allemande	8
8. Flaut amabile	8
9. Minor flute	4

PEDALE.

1. Principal	16
2. Octave	8
3. Fifth	$10\frac{2}{3}$
4. Fifth	$5\frac{1}{3}$
5. Super-octave	4
6. Violon	16
7. Violon	8
8. Gamba	16
9. Sub-bass	16
10. Double flute	8
11. Counter-diapason	32
12. Trombone	32
13. Trombone	16
14. Trumpet	8

Manual and pedal-copula. Instead of the quintatön, sixteen feet, in the great organ, a diapason sixteen feet might have been chosen. Instead of the eight feet gemshorn in the swell organ, a sixteen feet might have been used. The flaut allemande in the choir organ might be replaced by a soft reed-register. The fifth $5\frac{1}{3}$ feet in the pedale might be omitted, and give room for a clarion four feet.

V.—Arrangement of an Organ with 64 Registers.

GREAT ORGAN.

	Wide Scale.	feet.
1.	Double diapason	16
2.	Diapason	8
3.	Fifth	5⅓
4.	Fifth	2⅔
5.	Octave	4
6.	Super-octave	2
7.	Mixture, 6 ranks	4, 2⅔, 2, 1⅓, 1, ⅔
8.	Sharp, 4 ranks	2, 1⅗, 1⅓, 1
9.	Cornetto, 3 ranks	5⅓, 4, 3⅕
10.	Hohl flute	8
11.	Gamba, or double flute	8
12.	Quintatön	16
13.	Quintatön	8
14.	Traverse flute	4
15.	Trumpet	16
16.	Trumpet	8

SWELL ORGAN.

	Medium Scale.	
1.	Diapason	8
2.	Octave	4
3.	Fifth	2⅔
4.	Super-octave	2
5.	Mixture, 4 ranks	2, 1⅓, 1, ⅔
6.	Sesquialtera, 2 ranks	2⅔, 1⅗
7.	Gemshorn	8
8.	Salicet	8
9.	Salicet	4
10.	Rohr flute	16
11.	Rohr flute	8
12.	Rohr flute	4
13.	Flaut amabile	8
14.	Clarionet	8

CHOIR ORGAN.

	Narrow Scale.	feet.
1.	Diapason	8
2.	Octave	4
3.	Nasat	2⅔
4.	Super-octave	2
5.	Mixture, 3 ranks	2, 1⅓, 1
6.	Gamba	8
7.	Portunal	8
8.	Flaut minor	4
9.	Flaut douce	8
10.	Flaut major	8
11.	Spitz flute	4
12.	Bourdon	16
13.	Hautboy, or harmonica	8

PEDALE.

1.	Counter-diapason	32
2.	Double diapason	16
3.	Fifth	10⅔
4.	Diapason	8
5.	Fifth	5⅓
6.	Octave	4
7.	Mixture, 5 ranks	4, 2⅔, 2, 1⅓, 1
8.	Cornetto, 5 ranks	5⅓, 4, 3⅕, 2, 1⅗
9.	Violon	16
10.	Violon	8
11.	Gamba	16
12.	Sub-bass	16
13.	Quintatön	16
14.	Double flute	8
15.	Major bass	32
16.	Clarion	4
17.	Trumpet	8
18.	Bassoon	16
19.	Trombone	16
20.	Trombone	32

Copulas to all the manuals. With so many registers for the pedale, the pedal-copula is not required.

CHAPTER IV.

THE EXAMINATION OF A NEW OR REPAIRED ORGAN.

In order to avoid unpleasantness and fraud, the two parties, viz., the organ-builder and the corporation or private person for whom the organ is to be built, ought to agree beforehand about all the particulars, and have a written contract, in which all these particulars are clearly stated. When the work is finished, a competent person ought to be commissioned to examine the instrument, to see whether the contract has been strictly fulfilled on the part of the organ-builder. Sometimes, however, an organ-builder may have urgent reasons to depart in one particular or another from the written contract. In such a case, he cannot be blamed, if the deviation is without detriment to the whole work.

The principal duty of the examiner is to judge of the power and effect of the work as a whole. For this purpose, he must draw the whole of the registers, together with the copulas, and play upon the manual the fullest chords possible, as likewise on the pedale in octaves or in three or four parts. By this means, the examiner can see whether the bellows supply sufficient wind for the full organ, and especially for a sound, clear, and sure intonation in the lower octaves. After this he should play some full chords in a brisk, abrupt (staccato) manner, and the pedals in octaves, in order to see whether the intonation of the pipes is quick and yet strong. If this should not be the case, it would show that either the suckers on the bellows are too small, or the wind-conductors (great sound-board, canals, and grooves) too narrow to admit of a sufficient quantity of wind passing through them. Another test is, to sustain a chord with the right hand whilst the left plays some quick scale passages. Should the power of the tones in the right hand increase or decrease, it would indicate an imperfect supply of wind, in consequence of which the larger pipes rob the smaller ones of their portion of wind, so that the latter speak but slowly and faintly. Sometimes, when a few chords have been played staccato, and the last of them is kept on, another fault arises by this latter chord sounding, first too strong, and then decreasing after a few undulations. This arises from the bellows not being sufficiently provided with auxiliary weights, especially when they lay rather distant from the organ.

In playing the full organ, the examiner must pay particular attention to the effect of the mixture-registers, and see whether they render the whole mass of tone fresh and distinct, or whether they are too shrill and predominant. The same must be ascertained of the secondary-registers. The reed-registers must not rattle or bray, but produce an agreeable tone, which, with some of them, must at the same time be strong and full. The temperament and the tuning of the instrument must now be examined into, and for this purpose, every single tone of every register must be tried separately. Of those pipes, in particular, which receive their wind through separate conductors, it must be ascertained whether their intonation is quick and distinct, and if this should not be the case, it would prove that the conductors are too narrow.

The simultaneous sounding of another tone with the one which is intended to sound—a fault of which we have spoken in former chapters, and which is frequently found in new works of an imperfect construction—is discovered in the following manner: the registers are all pushed in, and then the keys of the manual are, by a ledge, or other contrivance, completely pressed down, and indeed all at the same time. The suspected fault, when really existing, will immediately manifest itself by a sort of whizzing. In organs of more than one manual, every manual must be examined separately, and, finally, the manuals must be coupled together. Another point of the examination are the *palates*. If they do not shut properly, their corresponding pipes, especially in the smaller registers, will hum or howl. In such a case, the faulty palates must be planed off anew, and provided with fresh leather, so as to fit better upon the openings of the grooves; or, if the imperfect closing should arise from the palate-springs being too weak, the latter must be taken out and replaced by new ones. All these springs must be of equal strength, otherwise an unequal or uneven touch would be the consequence. On the *key-boards* it must be ascertained whether the action of the keys is noisy or quiet. For this purpose, various allegro and staccato passages must be executed on the organ. The key-board must have the proper compass and the keys the proper position, with full length and breadth. Of the copulas it must be ascertained whether they move with sufficient ease, and whether the screws by which they are fastened are all in proper order. The stops must draw out neither too easily nor with too much difficulty, and without producing the least noise.

A most attentive and minute examination must be made of the *bellows*. The bellows-frame, upon which the bellows rest, must sit perfectly fast, and be sufficiently strong to bear the great weight resting upon it. The ribs of the bellows also must be sufficiently strong; and as the upper rib has to bear the auxiliary weights, it ought to be strengthened by wooden ledges going across it. Further, the leather-work and the sinews that connect the various ribs must be examined. The interior of the bellows should be entirely lined with paper, and the auxiliary weights should lay in a separate closed box. The bellows must not be too difficult to be blown, but so that a person of ordinary strength may do the work. When a pair of bellows are drawn up, the upper-rib of the bellows must form a horizontal line; the suckers must fit accurately. When all the bellows are blown and the organ is not played upon, none of the bellows must sink; and if the organ is played, the various pairs of bellows must not begin to sink all at the same time, but one after the other. Each pair of bellows must furnish an equal supply of wind. This the examiner must ascertain by means of the anemometer, in the mode described in a former chapter. If, when a pair of bellows are blown, the upper rib should immediately sink again a few inches, it proves that the suckers are too small, in consequence of which the bellows are not completely filled. The action of the bellows must be quiet and easy; shocks and jerks in the action are great faults, which must be immediately remedied. These jerks, however, are not to be considered as faults, when short, abrupt staccato chords are played on the full organ. In such a case, shocks or jerks are almost inevitable.

As regards the various *canals* and *wind-conductors*, it must be ascertained whether they are perfectly hermetical. On this occasion the stopping valves may be examined, especially as to whether or not they close exactly. The wind-chests must be hermetically shut up by closely fitting boards, which must be so contrived as to be easily taken out at any time. The great sound-board must be sufficiently wide to hold the requisite portion of wind, and to facilitate any repairs which may become necessary with the palates or palate-springs, &c. The palates, together with the springs and pegs in which and between which they move, must be constructed in the mode described in the preceding Part. If, instead of purses, plates or strips of brass are used, the examiner must see whether they are properly fastened and hermetically glued on to the wind-chest. The holes, through which the wires of the trackers go, must not be too large, lest some of the wind escape. The wire must, however, move freely, easily, and horizontally, so as to prevent all friction, whereby the holes might become larger.

The wind-chests, when once constructed, are not so easy to be examined as during their construction. The examiner must see that no holes are bored into the wind-chests or into the grooves, as a sort of artifice to hide some fault (the simultaneous intonation of another pipe with the one intended to sound, for instance). To facilitate the cleaning out of the grooves, Wilke proposes to provide holes opposite to the great sound-board, and keep them closely fitted with corks. As regards the upper-boards and other parts of the organ, we have already said how they ought to be constructed in the chapters wherein the description of them is given.

The roller-boards and roller-frames must be strong and properly fastened. The rollers, too, must be sufficiently strong and move easily in their pegs, though without speaking or clashing. Every roller must move without being in the least disturbed by its neighbour. The traces, trundels (or roller-arms), angle-hooks, and tracker-wires must move easily in their respective pegs, cuts, or sheaths, without causing any friction. As to the *pipes*, it must be ascertained whether they are composed of the material decided upon in the contract; whether the registers are of the proper scale and the proper proportion between the bass and treble; and whether the pedal-registers (especially those of diapason measure) have a full, strong tone. The wooden pipes must, on the inside, be varnished with glue and bole. The feet of pewter and brass pipes must be stronger than the bodies of the pipes. To ascertain whether a pipe is composed of pure pewter, or of the composition agreed upon in the contract, the following proceeding should be adopted :—two plates of equal size in every respect must be cast, the one of pure tin, or of that composition which is stated in the contract—the other of a part of the pipe which is to be examined. If the latter plate weighs heavier than the former, it proves that the pipe is not composed of pure pewter, or at least of an inferior composition to the one stated in the contract,—because lead, the inferior constituent, weighs heavier than pewter. The *stoppers* must be properly covered with leather, so as to sit firm and to fit accurately, in order to prevent their falling into the pipe, and in order to allow of a good, sound, and clear tone. All the pipes must fit perfectly into their respective holes in the upper-board. They must likewise stand firm and perfectly perpendicular. All registers should be so placed as to admit of an easy access, in case of tuning or a repair becoming necessary. Behind the front pipes the larger registers should stand first, the smaller ones last. Neither should the pipes stand too crowded, as this would impair their intonation.

In examining the reed-registers the following is to be observed. The bodies must stand fast, and must perfectly fit the holes of the block. The block and foot, too, must stand perfectly firm. The tuning-crooks must have elastic power sufficient to press the tongue properly upon the mouth-piece; they must not sit loosely in the block, and should project from the latter so as to be easily handled in case of tuning. The tongues must be composed of strong brass (which has first been properly hammered); they must be smoothly polished and kept fast upon the beak by suitable levers of hard wood. The curvature of the tongue must be exact, and of such a kind as to allow of the tuning-crook being driven upwards or downwards, according to circumstances.

In case the organ should require repair, we give the following hints. When the person who is to repair the organ makes his estimate of the cost, and takes, for this purpose, a survey of the organ, he ought always to be controlled by a second person, who is both competent and disinterested in the matter. For it has happened that dishonest organ-builders have made most extravagant charges, because there was no one to control them. The repairing is carried on in the following order:—first, the whole of the pipes are taken out and cleaned of all dust, dirt, &c., and as the interior of the organ is now accessible, the same must be done there. The pewter and brass pipes that are bruised or bent must be rounded off again, and the front pipes fresh polished. Those of the wood pipes which are worm-eaten must be glued over with paper and varnished with bole, or otherwise repaired or replaced by new ones. The various parts of the reed-pipes, such as the tongue, beak, &c., must be carefully freed from all dust, and, if damaged, put right again. Now the upper-boards are unscrewed from the wind-chests, cleaned, and, if necessary, planed off. After this the great sound-board is dusted, the palate and palate-springs examined, and, if any should be injured, corrected. The same is now done with the bellows, canals, and wind-chests, and particular attention must be paid to their being hermetically closed up. With the bellows, the measuring or weighing of the wind must not be forgotten. Now the action-work is examined, the damaged parts mended, and the worn-out screws and screw-worms replaced by new ones. The copulas, too, must be looked after, and the rattling or otherwise noisy action of the keys (in the manual or pedale) must be remedied, by a fresh supply of felt or leather being laid under them. Finally, the diapason is fresh tempered and tuned, and all the other registers tuned in the way already described. The repair having thus been completed, there ought to be, again, a person to examine whether the contract has been duly executed by the organ-builder;—for (we must repeat it) congregations or private persons are often imposed upon most shamefully. On the other side, care must be taken not to wrong the person who repairs an organ, by imputing faults to his workmanship which rest with the original construction of the organ.

PART VIII.

ARRANGEMENTS OR DESCRIPTIONS OF VARIOUS CELEBRATED ORGANS.

The study of good organ arrangements is, for organists, organ-builders, and amateurs, not only a very pleasant, but also a very instructive employment; for it teaches how to judge the works of other masters, and how to combine the various kinds of registers, in order to produce the finest and most varied effects. To those who are commissioned by the Government to examine the arrangements and estimates of organ-builders, this study is most important.

1.—The organ in St. Paul's, at Frankfort; 74 registers; builder, Walker, of Ludwigsburg, kingdom of Würtemberg.

FIRST MANUAL.	feet.
1. Diapason	16
2. Gamba major	16
3. Tibia major	16
4. Tuba	16
5. Counter-diapason	32
6. Octave	8
7. Viola di gamba	8
8. Gemshorn	8
9. Jubal flute	8
10. Trumpet	8
11. Octave	4
12. Hohl flute	4
13. Fugara	4
14. Super-octave, 2 ranks	2
15. Wald flute	2
16. Small octave	1
17. Cornetto, 5 ranks	10⅔
18. Mixture, 5 ranks	2
19. Sharp, 4 ranks	4
20. Fifth	5⅓
21. Gemshorn third	3⅕
22. Fifth	3⅔
23. Treble third	1⅗

SECOND MANUAL.	feet.
1. Diapason	8
2. Bourdon	16
3. Salicional	8
4. Dolce	8
5. Quintatön	8
6. Flute	8
7. Trombone	8
8. Vox humana	8
9. Octave	4
10. Traverse flute	4
11. Rohr flute	4
12. Super-octave	2
13. Quint-flute	5⅓
14. Gemshorn-quint	2⅔
15. Mixture, 5 ranks	2

THIRD MANUAL.	
1. Diapason	8
2. Quintatön	16
3. Harmonica	8
4. Bifara	8
5. Flute	8
6. Hohl flute	8

	feet.
7. Phys-harmonica	8
8. Hautboy	8
9. Spitz flute	4
10. Flute d'amour	4
11. Flute	4
12. Dolcissimo	4
13. Flautino	2
14. Nasat	2⅔

	feet.
8. Violoncello	8
9. Trumpet	8
10. Clarino	4
11. Octave	4
12. Cornettino	1
13. Fifth	10⅔
14. Third	6⅖
15. Fifth	5⅓

FIRST PEDALE.

1. Great diapason	16
2. Sub-bass (open)	32
3. Counter-bass (open)	32
4. Octave-bass	16
5. Violon	16
6. Trombone	16
7. Octave	8

SECOND PEDALE.

1. Sub-bass	16
2. Violon d'amour	16
3. Bassoon	16
4. Great diapason	16
5. Flute	8
6. Flute	4
7. Wald flute	2

This organ has 5 copulas; 2 crescendo stops; 3 manuals from C to $\overline{\overline{\overline{f}}}$ (54 keys), and 2 pedales from C to $\underline{d}$ (27 keys); 12 pairs of bellows, 14 feet long, 5 feet broad.

2.—The organ in St. Nicholas', at Hamburg; 67 registers; builder, Schnitker; finished in 1686.

GREAT ORGAN.

	feet.
1. Diapason	16
2. Quintatön	16
3. Trumpet	16
4. Octave	8
5. Salicional	8
6. Spitz flute	8
7. Gamba	8
8. Spitz flute	4
9. Octave	4
10. Octave	2
11. Rausch pipe, 3 ranks	
12. Sharp, 3 ranks	
13. Mixture, 6 ranks	
14. Trumpet	8

CHOIR ORGAN.

	feet.
1. Quintatön	16
2. Quintatön	8
3. Rohr flute	8
4. Octave	8
5. Vox humana	8
6. Cremona	8
7. Trumpet	8
8. Trumpet	4
9. Rohr flute	4
10. Octave	4
11. Flach flute	2
12. Cymbal, 3 ranks	
13. Nasat	3
14. Sharp, 4 or 6 ranks	

SWELL ORGAN.

1. Diapason	8
2. Block flute	8
3. Bear's pipe	8
4. Dulcian	8
5. Block flute	4
6. Wald flute	2
7. Octave	4
8. Tertian, 3 ranks	
9. Nasat	1½
10. Sharp, 3 to 6 ranks	

BACK CHOIR.

	feet.
1. Diapason	8
2. Bourdon	16
3. Dulcian	16
4. Trumpet	8
5. Half-trumpet, beginning with c upwards	6
6. Flute	8
7. Quintatön	8
8. Octave	4
9. Rohr flute	4
10. Traverse flute	2
11. Siff flute	1½
12. Sesquialtera, 2 ranks	
13. Sharp, 6 to 9 ranks	

PEDALE.

	feet.
1. Counter diapason	32
2. Trombone	32
3. Trombone	16
4. Fifth	12
5. Octave	16
6. Dulcian	16
7. Trumpet	8
8. Cremona	8
9. Octave	8
10. Violon	8
11. Trumpet	4
12. Octave	4
13. Flute	4
14. Gemshorn	2
15. Rausch pipe, 3 ranks	
16. Mixture, 6 to 10 ranks	

This organ had also 5 stopping-valves, a swell for the whole choir organ, 4 copulas, 16 pairs of bellows, and 39 degrees of wind. The deepest C of the counter-diapason thirty-feet weighed 860 lbs. This magnificent work was destroyed by the great fire in 1842.

3.—The organ in St. Michael's in Hamburg; built, in 1764, by Hildebrand; 64 registers.

GREAT ORGAN.

	feet.
1. Diapason	16
2. Quintatön	16
3. Trumpet	16
4. Trumpet	8
5. Octave, 2 ranks	8
6. Chalumeau or Shalm	8
7. Octave	4
8. Rohr flute	4
9. Octave	2
10. Nasat	3
11. Fifth	1½
12. Siff flute	1
13. Tertia, 2 ranks	
14. Rausch pipe, 2 ranks	
15. Cymbal, 5 ranks	

CHOIR ORGAN.

	feet.
1. Diapason	8
2. Rohr flute	16
3. Rohr flute	8
4. Flute minor	8
5. Traverse flute	8
6. Gemshorn	8
7. Flute major	8
8. Gamba	8
9. Octave	4
10. Gemshorn	4
11. Octave	4
12. Fifth	6
13. Sesquialtera, 2 ranks	
14. Nasat	3
15. Cornet, 5 ranks	
16. Mixture, 8 ranks	2
17. Sharp, 5 ranks	1½

SWELL ORGAN.

	feet.
1. Diapason	8
2. Bourdon	16
3. Spitz flute	8
4. Quint flute	8
5. Unda maris	8
6. Vox humana	8

	feet.
7. Trumpet	8
8. Octave	4
9. Spitz flute	4
10. Octave	2
11. Fifth	3
12. Cymbal, 5 ranks	1½
13. Rausch pipe, 2 ranks	
14. Echo, 5 ranks	

PEDALE.

	feet.
1. Counter-diapason	32
2. Sub-bass	32
3. Trombone	32
4. Great diapason	16
5. Sub-bass	16
6. Trombone	16
7. Bassoon	16
8. Rohr fifth	12
9. Fifth	6
10. Octave	8
11. Trumpet	8
12. Octave	4
13. Clarino	4
14. Mixture, 10 ranks	3

4.—The organ in the Protestant Cathedral at Cronstadt, in Transylvania; built, in 1839, by Buckholtz, of Berlin. The manuals extend from C to $\overset{\equiv}{g}$, the pedale from C to $\overline{g}$. It has nine pairs of bellows of large dimensions, and 68 register stops. It cost £5000.

GREAT ORGAN.

	feet.
1. Diapason	16
2. Quintatön	16
3. Diapason	8
4. Gemshorn	8
5. Gamba	8
6. Rohr flute	8
7. Nasat	5⅓
8. Octave	4
9. Spitz flute	4
10. Wald flute	4
11. Fifth	2⅔
12. Super-octave	2
13. Cornetto, 5 ranks	
14. Sharp, 5 ranks	
15. Cymbal, 3 ranks	

CHOIR ORGAN.

	feet.
1. Diapason	8
2. Salicional	16
3. Gamba	8
4. Traverse flute	8
5. Flute	8
6. Octave	4
7. Viola d'amour	4
8. Flauto dolce	4
9. Gemshorn	2⅔
10. Fifteenth	2
11. Progressio harmonica, 3 to 5 ranks	

SWELL ORGAN.

	feet.
1. Diapason	8
2. Bourdon	16
3. Salicional	8
4. Flute	8
5. Quintatön	8
6. Hohl flute	8
7. Octave	4
8. Fugara	4
9. Rohr flute	4
10. Nasat	2⅔
11. Hautboy	8
12. Super-octave	2
13. Mixture, 5 ranks	

REED MANUAL.

	feet.
1. Trumpet	8
2. Bassoon	16
3. Clarionet	8

	feet.
4. Vox angelica	8
5. Violino	8
6. Rohr flute	8
7. Diapason	4

The latter three are flue-registers.

PEDALE.

	feet.
1. Counter-diapason	32
2. Counter-bass	32
3. Counter-trombone	32
4. Great diapason	16
5. Violon	16
6. Sub-bass	16
7. Trombone	16
8. Nasat	10⅔
9. Diapason	8
10. Violone	8
11. Bass-flute	8
12. Gemshorn	8
13. Trumpet	8
14. Fifth	5⅓
15. Octave	4
16. Cornetto	4
17. Mixture, 4 ranks	4

5.—The organ in the Church of the Cross of Christ, at Hirschberg, in Selesia; built, in 1727, by Röder, of Berlin, and repaired, in 1830, by Buckow; 63 registers, 4 manuals and pedale, 3,844 pipes.

FIRST MANUAL.	feet.
1. Diapason	8
2. Great diapason	16
3. Nasat	5⅓
4. Super-octave	4
5. Fifth	2⅔
6. Vigessima-secunda	2
7. Mixture, 5 ranks	2
8. Sharp, 4 ranks	1⅓
9. Cymbal, 3 ranks	1
10. Rausch fifth, 2 ranks	1⅓
11. Quintatön	16
12. Gemshorn	8
13. Hohl flute	8
14. Flûte douce	4
15. Trumpet	16
16. Trumpet	8

SECOND MANUAL.

	feet.
1. Diapason	8
2. Octave	4
3. Fifth	2⅔
4. Super-octave	2
5. Third	1⅗
6. Flageolet	1
7. Mixture	2
8. Cymbal	1⅓
9. Quintatön	8
10. Bourdon	16
11. Flute	8
12. Gemshorn	4
13. Vox humana	8

THIRD MANUAL.

	feet.
1. Diapason	8
2. Octave	4
3. Super-octave	2
4. Fifth	2⅔
5. Mixture, 4 ranks	1⅓
6. Sesquialtera, 2 ranks	
7. Fugara	8
8. Flute	8
9. Rohr flute	4
10. Shalomo	8

FOURTH MANUAL.

	feet.
1. Diapason	8
2. Octave	4
3. Super-octave	2
4. Cornetto	1⅓
5. Flûte douce	8
6. Traverse flute	4
7. Bassoon	8
8. Hautboy	8

The latter two forming together but one register.

PEDALE.

		feet.
1.	Great diapason	16
2.	Octave	8
3.	Fifth	5⅓
4.	Super-octave	4
5.	Night horn	2
6.	Rausch-quint, 2 ranks	
7.	Mixture, 5 ranks	2⅔
8.	Counter-diapasons	32
9.	Violon	16
10.	Quintatön	16
11.	Sub-bass	16
12.	Violoncello	8
13.	Counter-trombone	32
14.	Trombone	16
15.	Trumpet	8
16.	Clarino	4

6.—The organ in the Cathedral at Breslau; built, in 1805, by Faneczek and Müller, sen., of Breslau (the same Cathedral has two other large organs, which are hereafter described); 60 registers; 4,700 pipes.

GREAT ORGAN.

		feet.
1.	Diapason	16
2.	Quintatön	16
3.	Salicet	8
4.	Gemshorn	8
5.	Quintatön	8
6.	Octave	8
7.	Trumpet	8
8.	Flute major	8
9.	Fifth	6
10.	Super-octave	4
11.	Rohr flute	4
12.	Gemshorn	4
13.	Fifth	3
14.	Twelfth	2
15.	Sharp, 4 ranks	
16.	Mixture, 7 ranks	

CHOIR ORGAN.

1.	Diapason	8
2.	Bourdon	16
3.	Double rohr flute	8
4.	Flaut allemande	8
5.	Salicet	8
6.	Octave	4
7.	Clarionet	8
8.	Salicet	4
9.	Double rohr flute	4
10.	Spitz flute	4
11.	Nasat	3
12.	Super-octave	2
13.	Cymbal, 3 ranks	
14.	Mixture, 6 ranks	

SWELL ORGAN.

		feet.
1.	Diapason	8
2.	Gamba	8
3.	Quintatön	8
4.	Flaut douce	8
5.	Flaut traverse	8
6.	Flaut major	8
7.	Hautboy	8
8.	Octave	4
9.	Flaut minor	4
10.	Fifth	3
11.	Super-octave	2
12.	Mixture, 4 ranks	

PEDALE.

1.	Counter-diapason	32
2.	Great diapason	16
3.	Violon	16
4.	Gamba	16
5.	Quintatön	16
6.	Sub-bass	16
7.	Trombone	32
8.	Trombone	16
9.	Bassoon	16
10.	Trumpet	8
11.	Gemshorn fifth	12
12.	Diapason	8
13.	Gemshorn	8
14.	Violoncello	8
15.	Double flute	8
16.	Fifth	6
17.	Sedecima	4
18.	Night horn	4

7.—The organ in the Church of St. Maria Magdalena, at Breslau; built, in 1725, by Röder, of Berlin, and entirely renovated, in 1821, by Engler; 55 registers.

GREAT ORGAN.

		feet.
1.	Great diapason	16
2.	Quintatön	16
3.	Diapason	8
4.	Flaut major	8
5.	Salicet	8
6.	Quintatön	8
7.	Trumpet	8
8.	Octave	4
9.	Rohr flute	4
10.	Fifth	3
11.	Super-octave	2
12.	Sharp, 4 ranks	1
13.	Mixture, 8 ranks	1⅓
14.	Rausch fifth, 2 ranks	3

SWELL ORGAN.

		feet.
1.	Diapason	8
2.	Gemshorn	8
3.	Flute major	8
4.	Salicet	8
5.	Vox humana	8
6.	Octave	4
7.	Fugara	4
8.	Double spitz flute	4
9.	Fifth	3
10.	Super-octave	2
11.	Wald flute	2
12.	Mixture, 6 ranks	1⅓
13.	Cymbal, 3 ranks	1⅓

BACK CHOIR.

		feet.
1.	Diapason	8
2.	Flute allemande	8
3.	Flute amabile	8
4.	Quintatön	8
5.	Hautboy	8
6.	Octave	4
7.	Portunal	4
8.	Fifth	3
9.	Super-octave	2
10.	Mixture, 3 ranks	

PEDALE.

		feet.
1.	Great diapason	16
2.	Major-bass	32
3.	Salicet	16
4.	Quintatön	16
5.	Sub-bass	16
6.	Violon	16
7.	Diapason	8
8.	Bass-flute	8
9.	Gemshorn fifth	6
10.	Super-octave	4
11.	Mixture, 5 ranks	
12.	Trombone	32
13.	Trombone	16
14.	Trumpet	8

8.—The organ in St. Wenzel's, at Naumburg; 52 registers, 3 manuals, 3,000 pipes, 7 pairs of bellows. Was first built in 1613, by Joachim Tzchug, and underwent several repairs, the last one by Beyer, on which occasion several alterations were made in the arrangement, in order to obtain a tone as full and pompous as possible. Among the new registers introduced, the flute traverse, gemshorn eight feet, and clavaeoline eight feet are particularly beautiful.

GREAT ORGAN.	feet.
1. Great diapason	16
2. Quintatön	16
3. Bombardone	16
4. Octave	8
5. Flaut major	8
6. Spitz flute	8
7. Trumpet	8
8. Principal	4
9. Spitz flute	4
10. Flute minor	4
11. Fifth	3
12. Wide principal	2
13. Octave	2
14. Cornetto, 5 ranks	
15. Mixture, 5 ranks	

SWELL ORGAN.	feet.
1. Bourdon	16
2. Diapason	8
3. Flute	8
4. Principal unda maris	8
5. Traverse flute	8
6. Clavaeoline	8
7. Principal	4
8. Gemshorn	4
9. Flute	4
10. Fifth	3
11. Octave	2
12. Wald flute	2
13. Siff flute	1
14. Mixture, 5 ranks	

BACK CHOIR.	feet.
1. Flute major	16
2. Diapason	8
3. Rohr flute	8
4. Quintatön	8
5. Gamba	8
6. Gemshorn	8
7. Fugara	8
8. Principal	4
9 Rohr flute	4
10. Octave	2
11. Mixture, 5 ranks	

PEDALE.	feet.
1. Trombone	32
2. Trombone	16
3. Sub-bass	16
4. Violon	16
5. Great diapason	16
6. Octave-bass	8
7. Violon	8
8. Trumpet	8
9. Fifth	6
10. Octave	4
11. Octave	2
12. Mixture, 5 ranks	

9.—The organ in the Barracks Church, at Breslau; 51 registers; built, 1842, by Wagner.

GREAT ORGAN.	feet.
1. Diapason	8
2. Gamba	8
3. Traverse flute	8
4. Rohr flute	8
5. Bourdon	16
6. Bassoon	16
7. Octave	4
8. Spitz flute	4
9. Octave	2
10. Fifth	3
11. Mixture, 4 ranks	
12. Cornetto, 5 ranks	
13. Sharp, 5 ranks	

CHOIR ORGAN.

	feet.
1. Diapason	8
2. Quintatön	16
3. Salicional	8
4. Flute	8
5. Trumpet, treble	8
6. Trumpet, bass	8
7. Octave	4
8. Fugara	4
9. Fifth	3
10. Octave	2
11. Wald flute	2
12. Siff flute	1
13. Sharp, 5 ranks	
14. Cymbal, 3 ranks	

SWELL ORGAN.

	feet.
1. Principal	4
2. Flute	8
3. Quintatön	8
4. Vox humana	8
5. Rohr flute	4
6. Octave	8
7. Flageolet	2
8. Nasat	2
9. Third	1⅗
10. Fifth	3
11. Cymbal, 4 ranks	

PEDALE.

1. Great diapason	16
2. Violon	16
3. Trombone	16
4. Trombone	32
5. Trumpet	8
6. Octave	8
7. Gemshorn	8
8. Fifth	6
9. Fifth	3
10. Night horn	4
11. Clairon	4
12. Mixture, 8 ranks	

10.—The organ in the Court Church (church of the Royal Family) at Dresden; 47 registers; builder, Silbermann.

GREAT ORGAN.

	feet.
1. Diapason	16
2. Bourdon	16
3. Bassoon	16
4. Trumpet	8
5. Octave	8
6. Gamba	8
7. Rohr flute	8
8. Octave	4
9. Spitz flute	4
10. Fifth	3
11. Super-octave	2
12. Third	1⅕
13. Cornet, 5 ranks	
14. Mixture, 4 ranks	
15. Cymbal, 3 ranks	

CHOIR ORGAN.

	feet.
1. Diapason	8
2. Quintatön	16
3. Unda maris	8
4. Flute	8
5. Quintatön	8
6. Vox humana	8
7. Octave	4
8. Rohr flute	4
9. Nasat	3
10. Octave	2
11. Third	1⅕
12. Flach flute	1
13. Cornet, 5 ranks	
14. Mixture, 4 ranks	4

SWELL ORGAN.

1. Principal	4
2. Flute	8
3. Chalumeau (shalm)	8
4. Rohr flute	4
5. Nasat	3
6. Octave	2
7. Third	1⅗

	feet.
8. Rohr flute	1
9. Cymbal, 3 ranks	
10. Sesquialtera, 4 ranks	

PEDALE.

1. Great diapason	16
2. Sub-bass	32

	feet.
3. Diapason	8
4. Octave	4
5. Mixture, 6 ranks	
6. Trombone	16
7. Trumpet	8
8. Clarino	4

11.—The organ in St. Vincenzius, at Breslau; 45 registers; builder, Zeuzius.

GREAT ORGAN.	feet.
1. Diapason	8
2. Quintatön	16
3. Flute	8
4. Unda maris	8
5. Salicional	8
6. Gemshorn	8
7. Portunal	8
8. Trumpet	8
9. Octave	4
10. Gemshorn	4
11. Rausch fifth	3½
12. Octave	2
13. Mixture, 6 ranks	
14. Cornetto, 4 ranks	
15. Cymbal, 3 ranks	

CHOIR ORGAN.

1. Principal	4
2. Quintatön	8
3. Flute	8
4. Gamba	8
5 Fugara	8
6. Trinona	8
7. Principal	8
8. Clarionet	8

	feet.
9. Flute	4
10. Trinona	4
11. Fifth	3
12. Octave	2½
13. Cymbal, 3 ranks	
14. Mixture, 4 ranks	
15. Traverse flute	4

PEDALE.

1. Great diapason	16
2. Sub-bass	16
3. Gamba	16
4. Violon	16
5. Quintatön	16
6. Major-bass	32
7. Trombone	16
8. Trumpet	8
9. Octave	8
10. Violon	8
11. Violoncello	8
12. Flute	8
13. Gamba	8
14. Gemshorn fifth	6
15. Octave	4

12.—The organ in the Church of St. Peter and Paul, at Liegnitz (Silesia); was entirely rebuilt, in 1839, by Buckow.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Gemshorn	8
4. Viola d'amour	8
5. Flauto grave	8

	feet.
6. Flauto douce	8
7. Octave	4
8. Flauto dolce	4
9. Fifth	2⅔
10. Super-octave	2

		feet.
11.	Flautino	2
12.	Progressio	2
13.	Cornetti	5⅓, 4, 3⅕

CHOIR ORGAN.

		feet.
1.	Quintatön	16
2.	Salicional	8
3.	Pyramidal flute	8
4.	Principal	4
5.	Biffara	4
6.	Flautino	2
7.	Hautboy	8
8.	Cornetti	2⅔, 2, 1⅗

SWELL ORGAN.

		feet.
1.	Diapason	8
2.	Principal	4
3.	Gamba	8
4.	Flauto amabile	8
5.	Flauto amoroso	4
6.	Spitz flute	2⅔
7.	Octave	2
8.	Flauto piccolo	1
9.	Mixture, 3 ranks	1⅓

PEDALE.

		feet.
1.	Diapason	16
2.	Violon	16
3.	Prestant (Principal)	16
4.	Sub-bass	16
5.	Principal	8
6.	Violoncello	8
7.	Bass-flute	8
8.	Fifth	5⅓
9.	Super-octave	4
10.	Small octave	2
11.	Trombone	16
12.	Trumpet	8

13.—The organ in St. Catherine's, at Salzwedel; 42 registers; built, in 1833, by Turley.

GREAT ORGAN.

		feet.
1.	Great diapason	16
2.	Diapason	8
3.	Fifth	5⅓
4.	Octave	4
5.	Fifth	2⅔
6.	Super-octave	2
7.	Sharp	2, 1⅗, 1⅓, 1
8.	Cymbal	1, ½, ¼
9.	Cornetto	5⅓, 4, 3⅕, 2
10.	Flute	8
11.	Spitz flute	8
12.	Rohr flute	4
13.	Dolce	4
14.	Trumpet	16
15.	Trumpet	8

CHOIR ORGAN.

		feet.
1.	Diapason	8
2.	Octave	4
3.	Super-octave	2
4.	Mixture, 4 ranks	
5.	Bourdon	16
6.	Flauto dolce	8
7.	Quintatön	8
8.	Gemshorn	4
9.	Nasat	2⅔
10.	Gamba	8
11.	Salicional	8
12.	Aeoline	16
13.	Hautboy	8

PEDALE.

1.	Great diapason	16
2.	Diapason	8
3.	Octave	4
4.	Compensation—Mixture, 5 ranks	
5.	Sub-bass	16
6.	Great nasat	10⅔
7.	Flute	8
8.	Third	6⅖
9.	Nasat	5⅓
10.	Violon	16
11.	Trombone	16
12.	Dulcian	16
13.	Trumpet	8
14.	Clairon	4

14.—The organ in St. Mary's, at Breslau; 41 registers; built, in 1722, by Wagner, and entirely rebuilt by Buckholz, in Berlin.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Gamba	8
4. Rohr flute	8
5. Octave	4
6. Spitz flute	4
7. Fifth	2⅔
8. Super-octave	2
9. Cornetto, 5 ranks	
10. Sharp, 5 ranks	
11. Cymbal, 3 ranks	
12. Trumpet	8

CHOIR ORGAN.	
1. Salicional	8
2. Gemshorn	8
3. Flute	8
4. Quintatön	8
5. Octave	4
6. Fugara	4
7. Flûte douce	4
8. Nasat	2⅔
9. Super-octave	2

SWELL ORGAN.	feet.
1. Diapason	8
2. Quintatön	16
3. Flute	8
4. Octave	4
5. Rohr flute	4
6. Nasat	2⅔
7. Super-octave	2
8. Siff flute	1
9. Mixture major, 4 ranks	
10. Mixture minor, 4 ranks	
11. Hautboy and bassoon, forming one register	8

PEDALE.	
1. Great Diapason	16
2. Violon	16
3. Sub-bass	16
4. Great nasat	10⅔
5. Gemshorn	8
6. Bass flute	8
7. Octave	4
8. Trombone	16
9. Counter-trombone	32

15.—The new organ in St. Nicholas's, at Zerbst; 37 registers; finished, in 1840, by Geibel and Zuberbier; six pairs of bellows, 10 feet long, 5 or 2 feet broad, three for the manual and three for the pedale; the former having 25, the latter 30 degrees of wind.

GREAT ORGAN.	feet.
1. Great diapason	16
2. Quintatön	16
3. Diapason	8
4. Gamba	8
5. Hohl flute	8
6. Flute	8
7. Trumpet	8
8. Super-octave	4
9. Gemshorn	4
10. Flute	4
11. Fifth	5⅓
12. Fifth	2⅔
13. Small octave	2
14. Cornet, 4 ranks	
15. Mixture, 6 ranks	2

CHOIR ORGAN.	
1. Diapason	8
2. Bourdon	16
3. Flute	8

	feet.
4. Quintatön	8
5. Traverse flute	8
6. Octave	4
7. Salicet	4
8. Flaut douce	4
9. Fifth	2⅔
10. Super-octave	2
11. Wald flute	8
12. Third	1⅗
13. Mixture, 4 ranks	3

PEDALE.	feet.
1. Great diapason	16
2. Sub-bass	16
3. Counter diapason	32
4. Violon	16
5. Violoncello	8
6. Diapason	8
7. Super-octave	4
8. Trombone	16
9. Trumpet	8

16.—The organ in the Church at Perleburg; 36 registers; built, in 1831, by Tobias Turley & Son.

GREAT ORGAN.	feet.
1. Diapason	8
2. Octave	4
3. Fifth	2⅔
4. Super-octave	2
5. Cymbal, 3 ranks	
6. Sharp, 5 ranks	
7. Cornetto, 3 ranks	
8. Hohl flute	8
9. Quintatön	16
10. Rohr flute	8
11. Spitz flute	8
12. Flaut douce	4
13. Gemshorn	4
14. Trumpet	8

CHOIR ORGAN.	feet.
1. Diapason	8
2. Octave	4
3. Super-octave	2
4. Mixture	1⅓, 1, ⅔
5. Traverse flute	8
6. Gamba	8
7. Bourdon	16
8. Flute	8
9. Rohr flute	4
10. Nasat	2⅔
11. Aeoline	16
12. Hautboy	8

PEDALE.	
1. Great diapason	16
2. Diapason	8
3. Octave	4
4. Counter-diapason	32
5. Sub-bass	16
6. Flute-bass	8
7. Great Nasat	10⅔
8. Third	6⅖
9. Trombone	16
10. Trumpet	8

17.—The organ in the Church of St. Bernhardinus, at Breslau; built, in 1705, by Casparini, and thoroughly repaired, in 1831, by Hartig; 35 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Quintatön	16
4. Flute major	8
5. Portunal	8
6. Gamba	8
7. Trumpet	8
8. Octave	4

		feet.
9.	Double flute	4
10.	Fifth	$2\frac{2}{3}$
11.	Super-octave	2
12.	Mixture, 5 ranks	
13.	Cymbal, 2 ranks	

CHOIR ORGAN.

1.	Diapason	8
2.	Flauto amabile	8
3.	Salicet	8
4.	Hautboy	8
5.	Octave	4
6.	Flute minor	4
7.	Fifth	$2\frac{2}{3}$
8.	Super-octave	2
9.	Cymbal, 2 ranks	
10.	Mixture, 4 ranks	

PEDALE.

		feet.
1.	Great diapason	16
2.	Major-bass	32
3.	Sub-bass	16
4.	Violon	16
5.	Fifth	12
6.	Violon	8
7.	Double flute	8
8.	Quintatön	8
9.	Octave	4
10.	Trombone	32
11.	Trombone	16
12.	Trumpet	8

The well-known Hesse, famous both as an organ-player and as a composer for the instrument, is organist in this church.

18.—The organ in the Church of St. Augustin, at Gotha; built, in 1841, by Schulze; 34 registers.

GREAT ORGAN.

Wide Scale, and a grand, brilliant intonation.

		feet.
1.	Great diapason	16
2.	Bourdon	32
3.	Bourdon	16
4.	Diapason	8
5.	Hohl flute	8
6.	Gamba	8
7.	Flute	4
8.	Hohl flute	4
9.	Octave	4
10.	Fifth	3
11.	Super-octave	2, 1
12.	Cymbal, 3 ranks	
13.	Mixture, 5 ranks	
14.	Cornetto, 3 ranks	
15.	Trumpet	8

CHOIR ORGAN.

Narrow Scale.

		feet.
1.	Violin principal	8
2.	Flaut douce	8
3.	Traverse flute	8
4.	Salicional	8
5.	Harmonica	8
6.	Flaut douce	8
7.	Flaut douce	4
8.	Octave	4
9.	Fifth	3
10.	Super-octave	2
11.	Sharp, 3 ranks	

PEDALE.

1.	Principal Bass	16
2.	Sub-bass	16
3.	Violon-bass	16
4.	Octave-bass	8
5.	Violon-bass	8
6.	Flute-bass	8
7.	Trombone	16
8.	Trombone	32

19.—The organ in the Catholic Collegiate Church, at Trebnitz (Silesia); built, in 1842, by the brothers Müller, in Breslau. It is a most excellent work; 33 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Salicet	8
4. Gemshorn	8
5. Rohr flute	8
6. Quintatön	8
7. Trumpet	8
8. Octave	4
9. Double rohr flute	4
10. Gemshorn-fifth	5⅓
11. Fifth	2⅔
12. Super-octave	2
13. Mixture, 5 ranks	

CHOIR ORGAN.	feet.
1. Diapason	8
2. Salicet	8
3. Portunal flute	8
4. Flute major	8
5. Salicet	4
6. Portunal	4
7. Gemshorn fifth	2⅔
8. Super-octave	2
9. Cymbal, 3 ranks	

PEDALE.	feet.
1. Great diapason	16
2. Gamba	16
3. Sub-bass	16
4. Salicet	16
5. Trombone	16
6. Quint-bass	10⅔
7. Octave-bass	8
8. Salicet	8
9. Double flute	8
10. Trumpet	8
11. Super-octave	4

20.—The organ in the Church of St. Sophia, at Dresden; built, in 1720, by Silberman; 31 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Spitz flute	8
4. Rohr flute	8
5. Octave	4
6. Spitz flute	4
7. Fifth	3
8. Super-octave	2
9. Third	2
10. Mixture, 4 ranks	
11. Cymbal, 3 ranks	
12. Cornetto, 5 ranks	
13. Trumpet	8
14. Clarionet	4

CHOIR ORGAN.	feet.
1. Diapason	8
2. Quintatön	16
3. Flute major	8
4. Quintatön	8
5. Octave	4
6. Rohr flute	4
7. Nasat	3
8. Super-octave	2
9. Fifth	1⅓
10. Siff flute	1
11. Mixture, 3 ranks	
12. Vox humana	8
13. Unda maris	8

PEDALE.	feet.
1. Principal-bass	16
2. Sub-bass	16
3. Trombone	16
4. Trumpet	8

21.—The organ in the Protestant Church, at Warsaw; built, in 1839, by Robert Müller, of Breslau; 27 registers; six pairs of bellows, 10 feet long, 5 feet wide.

GREAT ORGAN.	feet.
1. Great diapason (of tin)	16
2. Diapason	8
3. Gemshorn	8
4. Double flute	8
5. Portunal	8
6. Double rohr flute	4
7. Octave	4
8. Fifth	3
9. Super-octave	2
10. Mixture, 6 ranks	

CHOIR ORGAN	feet.
1. Principal	4
2. Salicet	5
3. Quintatön	8
4. Clarionet	8
5. Flute	8
6. Traverse flute	8
7. Salicet	4
8. Violini	2

PEDALE.	
1. Major-bass	32
2. Violon	16
3. Gamba	16
4. Sub-bass	16
5. Trombone	16
6. Trumpet	8
7. Octave-bass	8
8. Fifth	12
9. Octave	4

22.—The organ in St. Adelbert's, at Breslau; built, in 1837, by Müller, sen.; 24 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Salicet	8
4. Gemshorn	8
5. Bourdon	8
6. Clarionet	8
7. Octave	4
8. Double rohr flute	4
9. Fifth	3
10. Super-octave	2
11. Gemshorn fifth	6
12. Mixture, 5 ranks	

CHOIR ORGAN.	feet.
1. Principal	4
2. Salicet	8
3. Flute major	8
4. Portunal	8
5. Portunal	4
6. Super-octave	2
7. Cymbal, 2 ranks	

PEDALE.	
1. Great diapason	16
2. Gamba	16
3. Sub-bass	16
4. Trombone	16
5. Octave	8

24.—The organ in Triebel (Silesia); built, in 1831, by Buckow, of Hirshberg; 23 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Salicional	8
4. Hohl flute	8
5. Octave	4
6. Full flute	4
7. Fifth	2⅔
8. Super-octave	2
9. Mixture, 4 ranks	2
10. Trumpet	8

CHOIR ORGAN.	feet.
1. Principal	4
2. Gamba	8
3. Flute d'amour	8
4. Wald flute	2
5. Nasat	2⅔
6. Flageolet	2
7. Cornetti, 3 ranks	
8. Bassoon	8
9. Hautboy	8

The two latter forming one register.

PEDALE.	
1. Great diapason	16
2. Sub-bass	8
3. Diapason	8
4. Trombone	16

25.—The organ in the new Catholic Church at Krumöls (Silesia); built in 1837; 22 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Gemshorn	8
4. Hohl flute	8
5. Octave	4
6. Gemshorn	4
7. Fifth	2⅔
8. Super-octave	2
9. Progressio, 3 to 5 ranks	2
10. Trumpet	8

CHOIR ORGAN.	feet.
1. Principal	4
2. Gamba	8
3. Flût douce	8
4. Flût d'amour	4
5. Quinta dulcis	2⅔
6. Flautino	2
7. Piccolo	1
8. Cornetti, 3 ranks	

PEDALE.	
1. Great diapason	16
2. Sub-bass	16
3. Diapason	8
4. Trombone	16

26.—The organ in the Catholic Church at Katscher (Silesia); built, in 1843, by Müller, sen.; 21 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Salicet	8
4. Portunal flute	8
5. Double rohr flute	8
6. Trumpet	8
7. Principal	4
8. Double rohr flute	4

	feet.
9. Gemshorn fifth	2⅔
10. Super-octave	2
11. Mixture, 5 ranks	

CHOIR ORGAN.	
1. Diapason	8
2. Salicet	8
3. Flute major	8
4. Portunal	4

	feet.
5. Violini	2
6. Salicet	4

PEDALE.	
1. Violon	16
2. Sub-bass	16
3. Trombone	16
4. Violon	8

27.—The organ in the Church at Alt-Kemnitz (Silesia); built, in 1842, by Schneider, of Hirshberg; 20 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Gemshorn	8
4. Gemshorn	4
5. Octave	4
6. Fifth	2⅔
7. Super-octave	2
8. Mixture, 4 ranks	2
9. Trumpet	8

CHOIR ORGAN.	feet.
1. Principal	4
2. Gamba	8
3. Flût douce	8
4. Flût d'amour	4
5. Flautino	2
6. Cornetti	2

PEDALE.	
1. Violon	16
2. Sub-bass	16
3. Trombone	16
4. Violoncello	8

28.—The organ in the Church at Erdsmannsdorf; built, in 1840, by Buckow; 19 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Gemshorn	8
4. Principal	4
5. Gemshorn	4
6. Nasat	2⅔
7. Octave	2
8. Cornetti, 3 ranks	2
9. Progressio, 3 and 4 ranks	2

CHOIR ORGAN.	
1. Principal	4

	feet.
2. Salicional	8
3. Gamba	8
4. Flût douce	8
5. Flût d'amour	4
6. Flautino	2

Place for an eight feet reed register.

PEDALE.	
1. Violon	16
2. Sub-bass	16
3. Violoncello	8
4. Trombone	16

29.—The second organ in St. Elizabeth's, at Breslau; 17 registers.

MANUAL.	feet.
1. Diapason	8
2. Salicet	8
3. Quintatön	8
4. Flute major	8
5. Vox humana	8
6. Principal	4
7. Octave	4
8. Flute minor	4
9. Fifth	3
10. Super-octave	2
11. Cymbal, 2 ranks	
12. Mixture, 4 ranks	

PEDALE.	feet.
1. Violon	16
2. Sub-bass	16
3. Octave-bass	8
4. Double flute	8
5. Super-octave	4

30.—The organ in the Frauen Church at Görlitz; built, in 1838, by Buckow; 15 registers.

FIRST MANUAL.	feet.
1. Diapason	8
2. Bourdon	16
3. Flauto grave	8
4. Principal	4
5. Gemshorn fifth	2⅔
6. Super-octave	2
7. Mixture, 4 ranks	2
8. Cornetti grandi, 3 ranks	8

Space for an eight feet trumpet.

SECOND MANUAL.	feet.
1. Gamba	8
2. Flût douce	8
3. Dolciano	8
4. Flût d'amour	4

PEDALE.	feet.
1. Violon	16
2. Violoncello	8
3. Trombone	16

31.—The organ in the Ludwigs Church at Celle (Hanover); builder, Edward Meyer; 15 registers.

GREAT ORGAN.	feet.
1. Diapason	8
2. Bourdon	16
3. Rohr flute	8
4. Octave	4
5. Gemshorn	4
6. Octave	2
7. Mixture, 3 ranks	

CHOIR ORGAN.	feet.
1. Flute	8
2. Salicional	8
3. Rohr flute	4
4. Wald flute	2

PEDALE.	feet.
1. Diapason	8
2. Sub-bass	16
3. Octave	4
4. Trombone	16

32.—The second organ in the Church of St. Bernhardus, at Breslau; builder, Engler; 14 registers.

MANUAL.	feet.		feet.
1. Diapason	8	9. Cymbal, 2 ranks	
2. Gamba	8	10. Mixture, 4 ranks	
3. Portunal	8		
4. Quintatön	8	PEDALE.	
5. Octave	4	1. Violon	16
6. Traverse flute	4	2. Sub-bass	16
7. Fifth	2⅔	3. Diapason	8
8. Super-octave	2	4. Octave	4

33.—The organ in the Music-hall of the Breslau University; built, in 1833, by Robert Müller; 13 registers.

GREAT ORGAN.	feet.	CHOIR ORGAN.	
1. Diapason	8	1. Salicet	8
2. Portunal	8	2. Flute major	8
3. Octave	4	3. Traverse flute	4
4. Double rohr flute	4	PEDALE.	
5. Fifth	3	1. Violon	16
6. Super-octave	2	2. Sub-bass	16
Space for an eight feet to be added.		3. Violon	8
		4. Principal	4

34.—The organ in the Church of the Protestant Church-yard, at Breslau; builder, Engler; 12 registers.

GREAT ORGAN.	feet.	CHOIR ORGAN.	feet.
1. Diapason	8	1. Dulcian	8
2. Salicet	8	2. Flaut amabile	8
3. Quintatön	8	3. Double flute	4
4. Flute major	8	PEDALE.	
5. Octave	4	1. Sub-bass	16
6. Spitz flute	4	2. Quintatön	16
		3. Octave-bass	8

35.—The organ in the Chapel attached to the Cathedral at Breslau—a beautiful little instrument; built by Müller, sen.; 12 registers.

MANUAL.	feet.		feet.
1. Diapason	8	4. Gamba	8
2. Flaut allemande	8	5. Octave	4
3. Flute major	8	6. Double rohr flute	4

	feet.	PEDALE.	feet.
7. Nasat fifth	3	1. Sub-bass	16
8. Super-octave	2	2. Octave-bass	8
9. Mixture, 4 ranks		3. Super-octave	4

36.—The organ in St. Mauritius', at Breslau; builder, Lummert, of Breslau; 9 registers.

MANUAL.	feet.		feet.
1. Diapason	8	6. Fifth	3
2. Hohl flute	8	7. Super-octave	2
3. Flute	8	PEDALE.	
4. Octave	4	1. Sub-bass	16
5. Gemshorn	4	2. Octave-bass	8

37.—The new organ in All Saints', at Breslau; built and presented to the Hospital by the father of the celebrated Hesse in 1844; 8 registers, which produce a very fine effect.

MANUAL.	feet.		feet.
1. Diapason	8	5. Double rohr flute	4
2. Bourdon	16	6. Cymbal, 2 ranks	
3. Portunal	8	PEDALE.	
4. Octave	4	1. Sub-bass	16
		2. Bassoon	16

38.—The organ in St. John's, at Breslau (a chapel connected with the Cathedral); 8 registers.

MANUAL.	feet.		feet.
1. Principal	4	5. Flaut allemande	4
2. Salicet	8	6. Fifth	3
3. Quintatön	8	7. Super-octave	2
4. Flaut amabile	4	8. Mixture, 3 ranks	

39.—The organ in the Church of St. Aegidii, at Breslau; 6 registers.

MANUAL.	feet.		feet.
1. Principal	4	4. Fifth	3
2. Flute major	8	5. Super-octave	2
3. Quintatön	8	6. Mixture, 2 ranks	

APPENDIX.

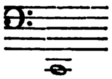
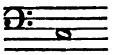
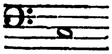
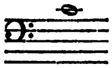
For many obvious reasons, which need not to be enumerated, it would be most desirable to attain greater uniformity and consistency in the *technical terms* used in music, not only with respect to different languages, but also with regard to the English language in particular. To this end (with respect to the English language), the best plan would be to borrow the requisite words from those nations to whom we are more especially indebted for the cultivation and promotion of this sublime art, viz., the Germans and Italians. As to organ-building, it cannot but be admitted that the Germans have never been excelled by any other nation. Their technical terms, therefore, ought to be a standard for other nations, and whenever there is no suitable word in the mother language, the original German word should be adopted. English organ-builders have already introduced some of these words, such as *gemshorn, wald flute, hohl flute,* and others. Throughout the present book the translator has used some technical terms, which he thinks it would be well if they were universally adopted. They are:—

1. *Manual.* Why should the English use the word *pedal,* derived from the Latin, *pes,* "the foot" (thus meaning a key-board for the foot), and not also its corresponding word *manual,* derived from the Latin, *manus,* "the hand" (thus signifying a key-board for the hand), the more so, as the word manual already exists in the English language? The word key-board is not a good substitute for manual, because the pedal is a key-board also. It would also be desirable to do away with the words great organ, choir organ, and swell organ (particularly as the two latter are

not clearly defined and not uniformly used), and to say simply—first, second, and third manual.

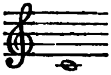
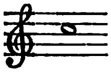
2. *Pedal.* In Germany, this word is used in a different and more extended sense than in England. Here it simply means a single pedal-key, and to represent the playing-pedals, is used in the plural; in Germany, however, it is understood as expressing the pedal-frame, pedal-keys, and, in fact, all connected with what in England is called the pedal-organ, and it is in this sense that the word (slightly altered by the addition of an *e* at the termination —*pedale*[*]) is used in the present work.

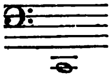
3. *Register.* This word the translator wishes fo substitute for *stop,* because it is used in several modern languages, and because the word stop is much better applied only to those handles or buttons which are drawn out, in order to make the registers sound. In the present book, where the various parts of the organ are so minutely described, it would have been almost impossible for the translator to dispense with the word register, because the author often speaks of "register" and "register-zug," both of which are termed "stop" in English.

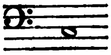
4. C to $\underline{d}$. This is an abridged mode of denoting the various tones of the bass and treble clef. In Germany the notes from C on the second ledger-line below the bass stave, up to the next c, from  to  are written with *capital letters.* Thus F means the f contained within this octave (which is called the great octave). The notes from the latter c to the next higher one, from  to  are written with *small letters.* Thus, d

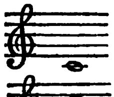
---

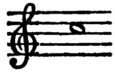
[*] It is right that a reason should here be given for this alteration in the orthography of the word. If the word *manual* is used to express the key-board, &c., for the hands, the simple word *pedal,* it will be said, ought to be sufficient to express the key-board, &c., for the feet. This is true, but it must be remembered that the former word has never been used in this country, except in the sense in which it is here employed, whereas the latter has long been in common use, but with a widely different signification, and as it is a difficult thing to give a new meaning to an old word, it has been deemed desirable (at all events, for the present) to leave the word *pedal* in its former signification, and to employ the word *pedale* to express the meaning of the German word.

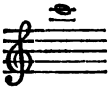
means that d which is contained in this octave, which is called the "small octave." From c on the first ledger-line below the treble stave, up to the next highest c, from  to  the tones are written with *small letters and a stroke* ($\underline{c}$). Thus, for instance, $\overline{g}$ means that g which is contained within this octave (called the octave with one stroke). For the next octave, two strokes, and for the following, three stokes are added to the letters; thus: $\underline{\underline{e}}$, $\underline{a}$, $\overline{\overline{\overline{b}}}$, and so on. In speaking, the Germans call—

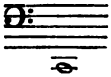
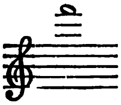
C the great C 

c the small c 

$\underline{c}$ the c with one stroke 

$\underline{\underline{c}}$ the c with two strokes 

$\underline{\underline{\underline{c}}}$ the c with three strokes 

Thus, if in the course of the book, it is said of a manual that it extends from C to $\underline{\underline{\underline{f}}}$, it means from  to 

After having understood this explanation, it will not be difficult to make out the other examples; but it must at once be evident that this system of expressing the sounds of the scale is both simple and concise.

THE END.

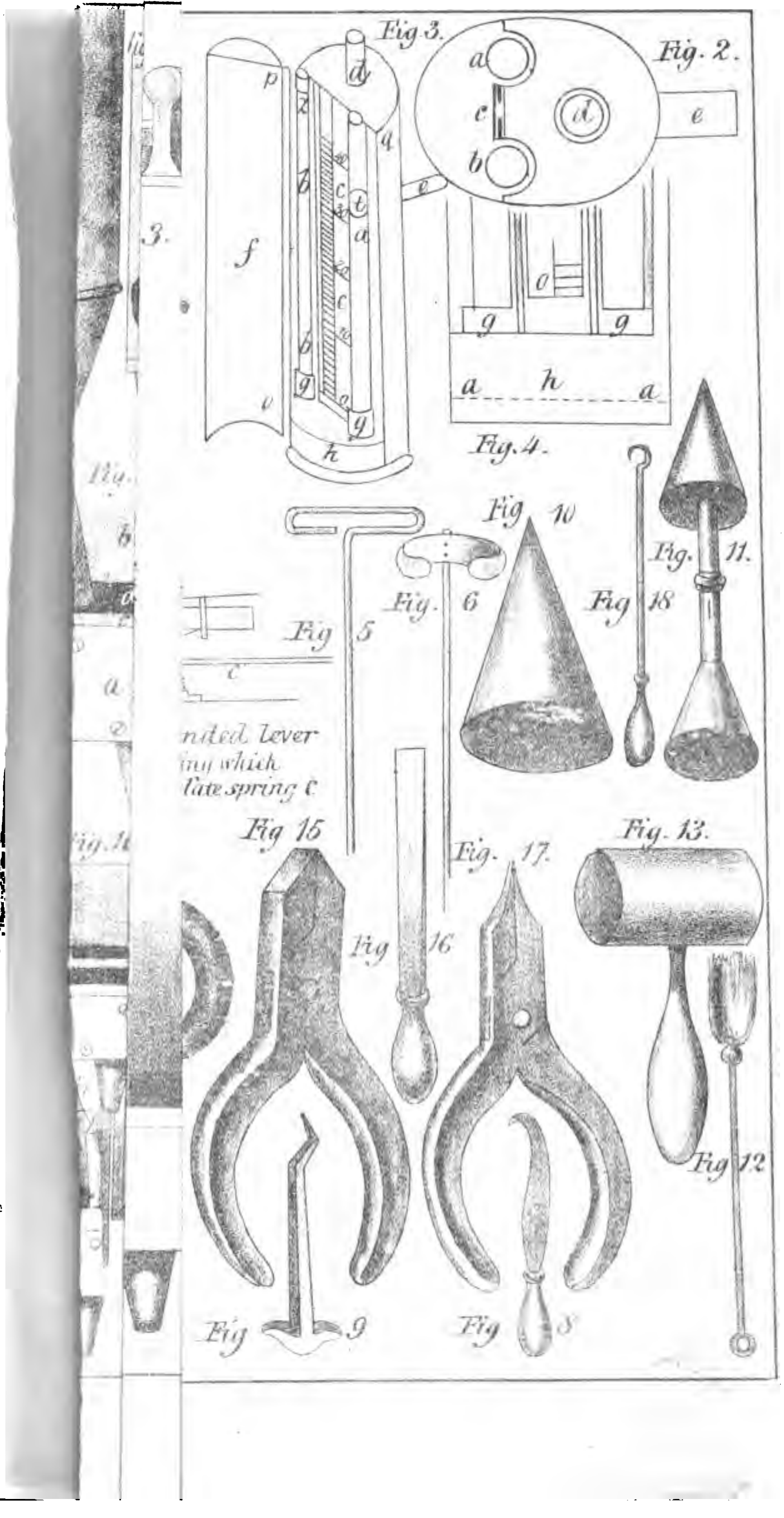


Fig 3.
d
p
z
q
b
c
t
a
e
f
c
b
g
o
g
h
Fig. 2.
a
c
d
e
b
o
g
g
a
h
a
Fig. 4.
Fig 10
Fig. 11.
Fig 18
Fig. 6
Fig 5
nded Lever
ing which
late spring C
3.
Fig.
b
a
Fig 15
Fig 16
Fig. 17.
Fig. 13.
Fig 12
Fig 9
Fig 8

AN EXTRACT

FROM

J. J. EWER & CO.'S

GENERAL CATALOGUE

OF

Music for the Organ.

		s.	d.
André, Ant.,	Ten Organ Pieces, Op. 68	3	0
André, J.,	Twelve do., for Divine Service, Op. 9	2	6
———	Nine do., of different characters, Op. 16	2	6
———	Three Adagios and Two Trios, Op. 19	2	6
———	Twelve Organ Pieces, for the use of Divine Service, Op. 21	3	0
———	Nine do., of different characters, for do., Op. 23	2	6
———	Twenty-four Organ Pieces of different characters, with or without Pedal, Op. 25	3	6
———	Theoretical Pract. Organ School, Op. 25	13	6
———	Twelve Organ Pieces, of different characters, Op. 26	3	0
———	Eight do. do. Op. 28	2	6
———	Twelve do. do. Op. 30	3	0
Bach, J. Seb.,	complete Organ Works, a new and beautiful edition, Vols. 1 to 7. Vols. 1, 2, 3, 5, 6, 7—each 16s. Vol. 4	13	6
———	Three Hundred and Seventy-one Chorales, new edition	13	6
Becker, C. F.,	Twenty-four Pieces for Divine Service, Op. 15	1	6
———	"Caecilla"—a collection of Organ Pieces of the most celebrated ancient Composers, as Studies, and for Concert use, Vols. 1 to 3 each	12	0
	Or separate, each Vol. in 6 Parts each	2	6
———	Sixty-six Four-part Choral Melodies to Spitta's Psalter and Harp	4	6
Beethoven, L. v.,	Two Preludes, Op. 39	1	6

		s.	d.
Brosig, M.,	Fantasia on the Chorale, "Christ ist erstanden," Op. 6	2	0
———	Five Chorale Preludes	2	6
———	Five Organ Pieces for Divine Service	2	6
———	Three Preludes and Two Afterludes, for the use of Divine Service, Op. 11	2	6
———	Three Preludes and Fugue, Op. 12	3	0
———	Two Preludes and Fantasia, with Andante and Fugato, Op. 15	2	6
———	Two Preludes, One Afterlude and Fantasia, Op. 13	2	6
Chipp, Edmund,	Introduction and Melody, varied, Op. 3	3	0
———	God preserve the Emperor	6	0
Fischer, M. G.,	Choral Book, Two thick Vols. each	18	0
———	Twenty-four Organ Pieces, for Beginners, Op. 15	4	0
———	Eight Chorales, Op. 16	1	6
———	Six Fugues, Op. 17	1	6
Freyer, A.,	Concert Variations on Russian Air	2	6
Gaebler, E. F.,	Introduction and Fugue for Two Performers, Op. 10	2	0
Geissler, C.,	Twenty Easy Pieces for Divine Service, Op. 82	4	0
———	Six Preludes in the Fugue style, and One Grand Fantasia, Op. 83—Books 1 and 2 each	3	0
———	Fifteen serious Pieces in the Church Style, Op. 94	3	0
———	Ten serious Pieces to be used as Preludes and Afterludes, Op. 95	3	0
———	Pieces for the use of Divine Service, different in character and form, Op. 97—Books 1 and 2 each	2	6
Handel. G. F.,	Six Overtures, arranged from the Score by Hennig:—		
	No. 1. Athalie	1	6
	2. Overture to a Psalm	1	6
	3. Overture to the Alexanderfest	1	6
	4. Messias	1	6
	5. Esther	2	0
	6. Saul	3	0
———	Choruses, arranged by J. Stevenson, Book 1	5	0
———	Six Grand Fugues	4	0
Herzog, J. G.,	Eighteen Organ Pieces, Op. 11	2	6
———	Twelve do. (Seven Preludes, Two Fughettas, and Three Afterludes,) Op. 17	4	6
———	Eight Organ Pieces for Divine Service, Op. 18	3	6
———	Six do. Op. 19	4	6
Hesse, A.,	Chorale, "Wer nur den lieben Gott," with Var., Op. 8	1	6
———	Fantasia, Op. 22	1	6
———	Nine easy Organ Preludes for Divine Service, Op. 24	3	0

Hesse, A.—*continued.*		*s.*	*d.*
———	Organ Preludes, of different characters, for Divine Service, Op. 25 ..	3	6
———	Three Chorales, one Prelude, and one Postludium, Op. 26—Two Books ....each	2	6
———	Eight Preludes for Divine Service, Op. 27	2	6
———	Preludes for do. Op. 28	2	6
———	Do. do. Op. 29	2	6
———	Eight Studies, with Pedal Obligato, Op. 30	2	6
———	Eighteen easy Preludes for Divine Service, Op. 31	2	0
———	Preludes for do. Op. 40	3	0
———	Eight Preludes as Studies, and for Divine Service, Op. 42	2	0
———	Eight instructive Pieces as do. do. Op. 51	2	0
———	Fantasia, with Prelude and Fugue on the name "Hesse," Op. 52....	2	6
———	Five Preludes and a Chorale, with Variations, Op. 53	2	6
———	Variations on the Chorale, "Sei Lob aud Ehr," and Postludium, Introduction and Fugue, in the style of Bach, Op. 54	2	6
———	Sixth Fantasia, with Chorale, and two Preludes, Op. 57	3	0
———	Seven Pieces of different characters, Op. 60	2	6
———	Two Fugues, with Introduction, and three Chorales, Op. 62	3	0
———	Four Pieces, Op. 63	3	6
———	Prelude and Fugue for Full Organ, Op. 64..........................	2	6
———	Variations on "God save the Queen," for Concert use, Op. 67	2	0
———	Silesian Chorale Book, third edition, Op. 69	12	0
———	Sundry Pieces, Op. 70	3	0
———	Three Preludes, one Trio, and Prelude to the Chorale, "Aus tiefer Noth," Op. 74.............................. ...	2	6
———	Fantasia, Op. 76	2	6
———	Pieces for Divine Service, and as Studies, Op. 77..................	2	6
———	Five Pieces of different character, Op. 81	4	0
———	Fantasia, Sonata, and two Preludes, Op. 83	4	0
———	Modulations	1	0
———	Twelve Studies, with Pedal Obligato	3	0
———	Compositions for Divine Service:—		
	Book 1. Organ Preludes, Op. 32	3	0
	2. do. Op. 33	3	0
	3. Variations on an original Theme, Op. 34.........	2	6
	4. Fantasia for four hands, Op. 35..............................	2	6
	5. Three Preludes, One Trio, and Concert Fantasia, Op. 36....	3	0
	6. Three Preludes, One Postludium, Fugue and Chorale, with Variations, Op. 37	3	0

Hesse, A.—*continued.*	s.	d.
Book 7. Variations on an original Theme, Op. 47	2	6
8. Preludes of different characters, Op. 48	3	0
9. Two Fugues, with Introduction, Op. 39	2	6
Hoepner, Chr. C., Thirty-four Pieces, Op. 14—Book 1	3	0
——— Ten Adagios, in the free style, with Introductory Remarks, complete	5	0
——— Do. singly, Nos. 1 to 10 each	1	0
——— Praludium and Fugue, in A	1	6
Koehler, E., Compositions for Divine Service, Op. 70:—		
No. 1. Fantasia on "Te Deum laudamus"	2	0
2. Do. on "Haydn's Creation"	2	0
——— Fantasia, Introduction and Variation on the Russian Hymn, Op. 72	2	6
Koenig, F., Introduction and Fughetta, with a Postludium, Op. 1	1	6
Koerner, G. W., The Young Organist; or collection of short and easy Pieces, with and without Pedal, new edition	12	0
——— The Practised Organist, a collection of Compositions by different Composers	12	0
——— The Perfect Organist, or collections of difficult Compositions, ancient and modern	12	0
——— The Organ Friend, a collection of Compositions of different characters, 12 Vols. each	9	0
——— Organ Journal, Vols. 1 and 2 each	9	0
——— New Organ Journal, a collection of Compositions of different characters, ancient and modern, 2 Vols. each	9	0
——— The Organ Virtuos, or collection of Pieces of every description, for use at Organ Concerts—Nos. 1 to 269 each 1 0 to	2	6
Krebs, J. L., Complete Edition of his Organ Comp.—3 Vols.—each Vol. in 3 Parts each	2	0
Kuehmstedt, F., "Gradus ad Parnassum;" or Introduction to Bach's Organ Compositions, containing Preludes and Fugues in all the keys, Op. 4—Books 1 to 8 each	2	0
——— Twenty-five easy and melodius Preludes, Op. 12	5	0
——— Eight Organ Pieces of different characters, as Studies, and for the use of Divine Service, Op. 17	1	6
——— Four Fugues as Afterludes, Op. 18	2	0
——— Grand Double Fugue, an effective Concert Piece, Op. 28	1	6
——— Fantasia eroica, Op. 29	2	6
Kunkel, F. S., Twelve Fughettas for Divine Service	1	6
Meister, F. S., Twelve Preludes	3	0

		s.	d.
Mendelssohn Bartholdy, F.,	Fughetta	1	0
———	Fugue from the Magnificat	1	0
———	Two Motetts, arranged—Nos. 1 and 2 ......each	1	6
———	Motett, " Ave Maria," arranged for Two Performers	1	6
———	A Selection of Choruses from Elijah, arranged from the Full Score, by Dr. Charles Steggall:—		
	No. 1. Help Lord	2	0
	2. Yet doth the Lord	2	0
	3. Thanks be to God	2	0
	4. Be not afraid	2	0
	5. He that shall endure, and Holy, Holy	2	0
	6. And then shall your light	2	0
	N.B.—Six other Numbers in the Press.		
———	Twelve Pieces from Elijah, in 2 Books—Book 1	3	0
———	Six Melodies from different Works, arranged by J. Hiles	3	0
———	Fugue from Op. 81, arranged by Miss E. Mounsey	1	6
———	Andante from the Fourth Symphony, arranged by Edmund Chipp	2	0
———	The Organ Part to Elijah	4	6
Mozart, W. A.,	Grand Chorus, arranged for Two Performers, by C. Severn	2	0
———	Introduction and Fugue, from the Requiem	1	6
———	Fugue in G minor	1	0
———	Fantasia in F minor, for four hands, with double Pedal, arranged by Hennig	4	6
Müller, P.,	Ten Adagios, Op. 5	2	6
Neukomm, S. v.,	Short and easy Mass	2	6
Rinck, C. H.,	Collection of Preludes, Interludes, and Afterludes, twelve easy Pieces, Op. 1	1	6
———	Twelve short and easy Preludes, with and without Pedal, Op. 2	1	6
———	Twelve Pieces, Op. 8	2	6
	Do. Op. 9	3	0
	Do. Op. 12	3	0
———	Twelve Preludes, Op. 25	2	6
———	Twelve Pieces, Op. 29	3	0
———	Twenty Pieces, Op. 33	4	6
———	Forty short and easy Preludes, with or without Pedal, Op. 37	3	6
———	Sundry Pieces, Op. 38	4	6
———	Six Chorales, with some Variations, Op. 40	5	0
———	Fifteen short Chorale Preludes, with or without Pedal, Op. 47	2	0
———	Twelve Afterludes, Op. 48	4	6

Rinck, C. H.—*continued.*		*s.*	*d.*
———	Twelve Preludes, with or without Pedal, Op. 49	2	0
———	Do. Op. 52	2	0
———	Twelve short Chorale Preludes, Op. 53	2	0
———	Practical Organ School, in 6 Books—Book 1, 6s.—2, 8s.—3, 5s. 6d.—4, 6s.—5, 6s. 6d., and 6, 6s. 6d.		
———	Six Variations, with Pedal, on an Air by Corelli, Op. 56	2	0
———	Twelve Adagios, Op. 57	3	0
———	Twelve Preludes, with or without Pedal, Op. 58	2	0
———	Twenty-four Chorales, Op. 64	7	0
———	Twenty-four Organ Preludes for Pupils, with or without Pedal, Op. 65	3	0
———	Twenty-four short Organ Pieces for Pupils, with or without Pedal Op. 66	3	0
———	Andante, with eight Variations (with Pedal obl.) Op. 70	2	6
———	Twelve Pieces in the Fugue style, for advanced Performers, Op. 72..	6	0
———	Twenty-four Preludes in all the keys, for Pupils, Op. 74	3	6
———	Six Chorales with Variations, for Pupils, for Divine Service, and as Studies, Op. 77	4	6
———	Three Afterludes, Op. 78	3	0
———	Introductory Lessons for Young Organists, Op. 82	12	0
———	Twenty-five Fughettas, Op. 84, in 2 Books ....each	4	6
———	Andante, with six Variations and Finale, with Pedal obligato, Op. 89	2	6
———	Nine Variations and Finale, Op. 90	2	6
———	Twelve Pieces, Op. 92	2	0
———	Thirty short Preludes, in all the keys, Op. 93	3	6
———	Twelve Pieces for Divine Service, Op. 94	2	0
———	Twenty-four Preludes, with Pedal, for Young Organists, Op. 95	2	6
———	Twelve Pieces for Divine Service. Book 3, Op. 96—Book 4, Op. 100.................................... .....each	2	0
———	Preludes to Chorales generally used in the Lutheran Church, Op. 104.	16	0
———	Eighteen Pieces for Divine Service, Op. 106	3	0
———	Thirty Afterludes, Op. 107	6	0
———	Introduction, with four easy Variations and Finale, on a Theme by Corelli, Op. 108	2	0
———	Fifteen Afterludes, Op. 114	3	6
———	Forty-eight Preludes, Op. 116, in 2 Books ....each	2	6
———	Exercises, and twenty-four Pieces in the Fugue style, in all the keys, Op. 120	8	0
———	The first three months on the Organ: an introduction to the Instrument, Op. 121..	6	6

		s.	d.
Rinck, C. H.—*continued,*			
———	The Choral Friend; or collection of Studies for the performance of the Chorale, 10 vols. each	6	0
Ritter, A. G.,	Thirty-two Chorales most in use, with Introductions, Op. 13.	4	0
———	Pieces for Divine Service, 4 Books each	1	6
———	Sonata, Op. 11, in D minor	2	6
———	Thirty-two of the most usual Chorales, with Preludes, Interludes, and Afterludes, Op. 13	4	0
———	Sonata, Op. 19, in E minor	3	0
Schellenberg, H.,	Fantasia on "Eine feste Burg," Op. 3	2	6
———	Fantasia, Op. 10	4	6
Schneider, J.,	Fantasia and Fugue, Op. 1, in C m	3	0
———	Fantasia and Fugue, Op. 3, in D m	3	0
Schumann, R.,	Six Fugues on the name of "Bach," Op, 60	7	0
Spohr's	Vocal Mass, arranged by C. SEVERN	5	0
Steggall, Dr. Charles,	Three Preludes and Fugues	3	0
Trutschel, A. L. E.,	Twelve Afterludes, Op. 11	2	6
———	Preludes on the usual Melodies in the Protestant Church, Op. 14	5	6
———	Fantasia as Afterlude, Op. 17	1	6
Volckmar, W.,	Forty short and easy Preludes, Op. 21	3	0
Wagner, E. D.,	Forty-eight Chorale Preludes for Divine Service, Op. 16	6	0
Wedemann, W.,	Organ Instructor, in 112 easy Exercises, and 76 Chorale Preludes	9	0
Zimmers, T.,	Versettes in the minor and major keys, Op. 16, Books 1 & 2, each	3	0
Zundel, J.,	Two Organ Fugues, Op. 4	1	6
Seidel, J. J.,	**The Organ and its construction, a systematic handbook, for Organists, Organ Builders, etc.**	**8**	**0**

Mus 362.2.2
The organ and its construction : a
Loeb Music Library BDF0521
3 2044 041 158 759

This book should be returned to the Library on or before the last date stamped below.

A fine of five cents a day is incurred by retaining it beyond the specified time.

Please return promptly.

~~DUE DEC 4 '47~~
5

~~DUE APR 15 '49~~

~~DUE JUL 20 '49~~

~~DEC - 2 '50~~

JAN ~~24 '53~~ H